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ABSTRACT

Topics of NECC '98 (National Educational Computing Conference) papers presented at this conference on technology in education include: digital portfolios; technology-integrated multidisciplinary curriculum design; a virtual Web site; a computer literacy course; Internet projects for various subjects; staff development; music videos; interaction of presentation mode and learning style; home/school connections; professional development; schoolwide reform; statewide technology-based cooperative programs; World Wide Web graduate educational technology courses; teacher training with CD-ROM and World Wide Web; Web site development; videoconferencing; virtual reality; HyperStudio animation; multimedia educational resources; classrooms as international learning communities; collaborative learning in graduate study; online teacher education communities; digital camera in the classroom; constructivist classrooms; gender equity; collaborative activities; enhancing literacy; troubleshooting; knowledge networks; materials for students with disabilities; virtual schools; educational improvement; standards-based curriculum; support staff; policy issues in open learning; quality assessment; computer labs; benchmarks; laptop schools; distance learning; parental involvement; wireless infrastructure in education; simulation design; intranets; instructional strategies; AskERIC; GEM; empowerment; spreadsheets; search strategies; mentor programs; and evaluating technology. (AEF)

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NECC '98
National Educating Computing Conference
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Arnie Abrams, Workshop

Creating Digital Portfolios

Trudy Abramson, Society Session/Curriculum Design/Strategies

Rising to the Challenge

Richard Alexander, Curriculum Design/Strategies

The Critical Issues Forum: A Multidisciplinary Curriculum Design Integrating Computer Technology

Catherine Alfieri, Poster Session

Virtual Pittsford Web Site: Time Travel Through Our Town, and Virtual USA: Time Travel Through Our Country

J. Thomas Allen, Jr., K–16 Computer Science

Narrowcasting the Computer Literacy Course

Gina Amenta, Technology Training/Staff Development

Beyond Technology Integration

Margarita Aste, Curriculum Designs/Strategies

Quipus Internet Spanish Projects

Nancy Atkins, Poster Session

Using the Teaching With Technology Instrument for Staff Development Planning

Deborah Aufdenspring, Curriculum Design/Strategies

Using Music Videos: Humanities for the MTV Generation

John Avitabile, Paper Session

Interaction of Presentation Mode and Learning Style in Computer Science

Janet Azbell, Exhibitor Session/Emerging Technologies

IBM Learning Village: Maximizing the Home/School Connections

Kathryn Bailey, Poster Session

National Geographic Kids Network Transforms Classroom Learning With Internet-Based Technology and Hands-On Science

Nancy Baker, Poster Session

Incorporating Technology With Native American Studies in the Elementary Classroom

Catherine Barrette, Poster Session

Writing for a Real Audience: Foreign Language Students' Web Publications

Regina Barton, Workshop

Letting the Curriculum Drive the Classroom Use of Technology: A Model for Professional Development

Henry Becker, ISTE Society Session/Curriculum Design/Strategies

Implementing Schoolwide Reform Through Community Support and a National Network

Sylvia Bienvenu, Poster Session

Water Resources: A Statewide Collaborative Challenge

Margaret Bingham, Technology Leadership

The ABCs of a Statewide Framework for Instructional Technology Success

George Blakeslee, Curriculum Design/Strategies

World Wide Web--Online Graduate Educational Technology Courses

Alec Bodzin, Teacher Training/Staff Development

Training Science Teachers With a CD-ROM and a World Wide Web Support Network

Gerald Boerner, Workshop

Developing a Web Site With FrontPage 97 and Access 97

Gerald Boerner, Curriculum Design/Strategies

Supporting Videoconferencing With Web-Based Tutorials

Barbara Bray, Spotlight Session

Technology Staff Development: A Different Angle

John Brim, Curriculum Design/Strategies

QuickTime VR and Internet Production of Student Resources

Ann Brundige, Poster Session

Survey of HyperStudio Animation

Ann Brundige, Workshop

Hands-On HyperStudio Animation, From A to Zoom!

Steven Bryan, Workshop

Multimedia, Java, and HTML With Digital Chisel 3

Warren Buckleitner, Spotlight Session

Supporting Your School's Curriculum: Your Dream Elementary Classroom

Ellen Davis Burnham, Internet Poster Session

Connect-2-Tomorrow, Today!

R.W. Burniske, SIG/Tel Workshop

Dancin' to a Global Beat: Classrooms as International Learning Communities

Jean Camp, Technology Leadership

Mandated Computer Competence: One State's Method of Compliance

Elizabeth Campbell, Curriculum Design/Strategies

Creating Virtual Environments for Collaborative Learning at the Graduate Level

Terence Cannings, Paper Session

Online Communities as a Vehicle for Developing Secondary Mathematics Educators

Molly Carbo, Workshop

Go Anywhere Multimedia: Digital Camera in the Classroom

Joanne Carney, Technology Leadership

ISTE's SIGTE Paper Award: Integrating Technology Into Constructivist Classrooms---An Examination of One Model for Teacher Development

Marian Caroselli, Emerging Technologies

If Only We Knew Anatomy of a Multimedia Project

Cynthia Carter Ching, Paper Session

Give Girls Some Space: Gender Equity in Collaborative Technology Activities

Melodee Carter-Guyette, Poster Session

High-Capacity Digital Portfolio System

Susan Cherup, Technology Training/Staff Development

Integrating Technology Into Teacher Education Classes

Alice Christie, Paper Session

Using Technology to Enhance Literacy in Elementary School Children

Robert Coil, Technology Training/Staff Development

The Trouble With Troubleshooting

Bill Colangelo, Curriculum Design/Strategies

Redefining Literacy With Multimedia Technology

Eric Cooper, Exhibitor Session/Educational Reform and Issues

Building Local and Wide-Audience Knowledge Networks

Susan Cooper, Special Needs

Emerging Technologies for Teaching and Learning of Students With Disabilities

Karen Creech, Teacher/Professor Productivity

Teachers Connect

Kim Crum, Poster Session

Exploring New Galaxies

Becky Daniels, Workshop

You Want This Network Completed When?

Marla Davenport, Workshop

Tips and Techniques for Developing Internet Projects

Kevin Davies, Spotlight Session

The Arrival of Virtual Schools: A Threat or an Opportunity?

Hilarie Davis, New Curriculum Design/Strategies

Making Thinking Visible

Jennifer Davis, Workshop

JAVA Beans, the Classroom, and Beyond

Chris Dede, Spotlight Session

The Potential of Virtual Reality to Improve Education

Mike DeSchryver, Curriculum Design/Strategies

Computer Mastery and Cold Fusion: A Dynamic Web-Based Curriculum

Darlene Devaney, Curriculum Design/Strategies

Tools and Templates for Terrific Standards-Based Curriculum Units

Linda Dickeson, Technology Leadership

Supporting a FAT Technology Program With a SLIM Support Staff

David Dockterman, Exhibitor Session/Curriculum Design/Strategies

Cooperative Learning and Technology

Peter Donkers, Educational Reform

Open Learning in K–12: Policy and Implementation Issues

Karen Douse, Curriculum Design/Strategies

Technology and Girls: Curriculum Ideas That Work

Kristin Droege, Technology Training/Staff Development

Online Communities of Learners: Technology-Based Approaches to Professional Development

Duane Duxbury, Teacher/Professor Productivity

Standards-Based Integrated Curriculum Development

J. Philip East, K–16 Computer Science

Including Quality Assessment in Programming Instruction

Gloria Edwards, Curriculum Design/Strategies

Transforming the Computer Lab Into a Cognitive Learning Environment

Roger Ehrich, Paper Session

Design of Technology-Based Learning Environments That Support Both Teachers and Students

Penny Ellsworth, Workshop

Cooperative Learning and Technology: Activities and Assessment

Cathy Fiore, Spotlight Session

Girl, Girls, Girls

Leslie Flanders, Workshop

The Scott County Teachnology Project: TILTing the Use of Technology in the Classroom

Susanne Flannelly, Poster Session

World Studies Interdisciplinary Project: Integrating Technology With Social Studies

Kathleen Flickinger, Internet Poster Session

ProjectBIO: College Science Instruction Via the Internet

Teresa Franklin, Poster Session

Co-Learners: Creating a New Paradigm for Staff Development

Michael Frym, Curriculum Design/Strategies

Exit Exhibitions: How to Drive Technology With Benchmarks

Grace Fujiyoshi, Poster Session

Engaged Learning Using Technology

Judi Fusco, Workshop

Tapping Into Online Teacher Professional Development

Rebecca Goehl, Workshop

Using Technology to Open Your Classroom to the World

Mark Grabe, Poster Session

Grandparents Attic: Linking Learning to Life

Janet Graeber, Laptops

In Our Laps! Student/Teacher Training at a Laptop School

Regina Halpin, Paper Session

Computer Literacy Taught Through Student-Centered Activities in Elementary Teacher Education: Constructivist Theory Put Into Practice

Anne Hamilton, Curriculum Design/Strategies

Incorporating Technology in an Integrated Arts Program

Marianne Handler, Technology Training/Staff Development

A Collaboration of Five Teacher Training Institutions: Preparing Illinois Educators for the 21st-Century Background

Dennis Harper, Spotlight Session

Generation WHY

Judi Harris, Spotlight Session

Wetware: Design Tools for Curriculum-Based Telecomputing Projects

Ted Hasselbring, Exhibitor Session/Curriculum Design/Strategies

The Computer Doesn't Embarrass Me

Brent Hefner, Internet Poster Session

Online Professional Development: A Viable Alternative to Traditional Methods

Lee Hermer, Emerging Technologies

Technology A Beacon for Change

Jeannine Herron, Curriculum Design/Strategies

Phonics-Based Touch-Typing and Writing With Computers Boost Primary Reading Scores

Joyce Hicks, Exhibitor Session/Teacher/Professor Productivity

The Future Is Here: Automating Your District

Cyndy Hoberman, Exhibitor Session/Special Needs

Access to Curriculum for Students With Disabilities: An Overview of IntelliTools Creativity Tools

Marilyn Hofer, Workshop

Excite Your Language Arts Curriculum With Video

Helen Hoffenberg, Education Reform and Issues

Reforming and Restructuring the Chicago Public Schools Through Technology Initiatives

Bob Hoffman, Educational Reform and Issues

Mystery of the Mission Museum: VR Environments for Student Interpreters

Joe Huber, Workshop

Constructing a Wireless LAN and WAN

Teresa Huffman, Internet Poster Session

Museums in the Classroom: Illinois Inventors and Authors

Beverly Hunter, Paper Session

Building Capacity for Innovation: The Vanguard for Learning Model

Mary Jones, Poster Session

Training That Makes Teachers Technology Evangelists

Yasmin Kafai, Paper Session

Collaborative Educational Multimedia Design by Children: Do All Learners Benefit Equally?

Ted Kahn, Spotlight Session

DesignWorlds for Learning: Virtual Collaborative Creativity

Linda Kantor Goodwin, Laptops

eMate Fever!

Jim Kaput, Curriculum Design/Strategies

SimCalc: Democratizing Access to Ideas Underlying Calculus Beginning in Middle Grades and Earlier

Tim Keiper, Internet Poster Session

The Web as a Resource for Producing Quality Performance Assessments

Rob King, Curriculum Design/Strategies

An Overview of the National Education Supercomputer Project at Lawrence Livermore National Laboratory

Anne Knight, Workshop

Professional Development Planning: Can You Succeed Without It?

Melinda Kolk, Exhibitor Session/Emerging Technologies

Harnessing the Power of the Internet With HyperStudio

Susan Krug, Workshop

Secrets for Success: Advanced HyperStudio Techniques

Maria Lorna Kunnath, Paper Session

Engineering Undergraduate Distance Learning Programs: An Assessment

Barry Kurtz, Paper Session

Developing Educational Materials in Java: A Report From the Front Lines

Michael Land, Technology Training/Staff Development

Teaching About Versus Learning With Technology

Michael Latta, Curriculum Design/Strategies

Catch the Connection (Classroom, Community, and Careers)

Eric LeMoine, Poster Session

Supporting Classroom Instruction With Technology

Jim Levin, Internet Poster Session

Teaching Teleapprenticeships: Frameworks for Using Technologies

Laura Lewis, Workshop

Building Virtual Museums, Online Exhibits, and Exploratoriums

Pat Lewis, Workshop

Teaching the Internet Without Blood, Sweat, Tears, or Lawsuits

Rena Lewis, Internet Poster Session

The Project LITT Web Site: Hypermedia-Based Literature for Students at Risk

Deborah Lowther, Curriculum Design/Strategies

How to Manage Successful Use of Computers in Your Classroom

Bryan MacDonald, Poster Session

Technology-Enhanced Assessment and Parental Involvement

Bryan MacDonald, Emerging Technologies

Wireless Infrastructure in Education

Sandi MacLeod, Poster Session

Leading a Network: Guiding Growth

Susan Marino, K–16 Computer Science

A Recipe for Capturing and Maintaining Girls' Excitement Using Technology

Sue Marshall, Curriculum Design/Strategies

Project-Based Learning and Simulation Design in the Science Classroom

Steven Marx, Workshop

Developing and Using Intranets in Schools: A Hands-On Primer

James Masker, Workshop

Negotiating Global Issues With Other Schools in Your Classroom

Leah McCoy, Curriculum Design/Strategies

Instructional Strategies on a Computer-Immersion Campus

Sharon My Bell, Spotlight Session

How Do I Know That Professional Development Activities Are Reaching the Child's Desk?

H. Willis Means, Curriculum Design/Strategies

Authentic Assessment of Computer-Mediated Conferences

Dean Mehrer, Curriculum Design/Strategies

I.B.E.C.—Internet-Based Educational Curriculum

Bonnie Meltzer, Workshop

Mini-Bio Book: Make a Book With One Piece of Paper and ClarisWorks

Bonnie Meltzer, Workshop

The Web Isn't Print: Preparing Photos for Web and Print

Annemarie Merow, Workshop

CD-ROM Design and Production in the K–12 Classroom

Cathy Miles Grant, Curriculum Design/Strategies

Enriching Curriculum Packages With Technology: Help for Technology Specialists

Marios Miltiadou, Poster Session

Cyprus's Bridge to the World

David Mintz, Workshop

An Educational Technology Organizer: Supporting World-Class Student Achievement

Bonnie Mohnsen, Curriculum Design/Strategies

Physical Education Instructional Technology for Improved Learning

Herb Moore, Curriculum Design/Strategies

Found Sounds: The Bridge Between Physical Space and Cyberspace

Nancy Morgan, Poster Session

The AskERIC Service: Technology Enabling Educational Communication via the Internet

Nancy Morgan, Poster Session

GEM: One-Stop Any-Stop Access to Educational Materials on the Internet

Joyce Morris, Internet Poster Session

Teaching With Technology: Virtually Another Dimension

David Moursund, Workshop

Project-Based Learning Using Information Technology

Lori Mullen, Poster Session

Keeping PACE with the Future: Parents and Children in Education

Aaron Munter, Exhibitor Session/Emerging Technologies

GlobalTrek: On the Road to Discovery!

Margaret Niess, Curriculum Design/Strategies

Technology: An Essential Tool in Teaching and Learning Mathematics

Margaret Niess, Curriculum Design/Strategies

Effects of El Nino: Analyzing and Interpreting the Climate Data

David Niguidula, Curriculum Design/Strategies

What Is and What If: Technology Tools for School Reform

Aileen Nonis, Technology Training/Staff Development

The Technology Infusion Project (TIP): An Inservice/Preservice Collaboration

Kathy Northrop, Curriculum Design/Strategies

CLASS----Using Innovative Technology for Extended Education

Charlotte Owens, Paper Session

Northeast Louisiana University Teacher Enhancement Program

Alex Pan, Paper Session

Effective Means to Help Teachers Master Computer Applications

Allen Parrish, IEEE-CS Society Session/K–16 Computer Science

Assessing the Computer Literacy Needs of K–12 Teachers

Allen Parrish, IEEE-CS Society Session/K–16 Computer Science

Teaching C++ Programming to High School Students

Agnes Patterson Zaorski, Curriculum Design/Strategies

Soar Online With Native American Students: Keypals Intercultural Telecollaborative Experience

Laurie Pattison-Gordon, Poster Session

Internet Collaboration in Support of Education Reform: A Progress Report on Two Projects

Calvin Pearce, Exhibitor Session/Technology Training/Staff Development

Achieving Computer Literacy and Improved Academic Performance for Least-Privileged Students

Robert Perkins, Poster Session

Creating an Intranet to Deliver World Wide Web to the Second Grade

Larry Pinto, Workshop

Becoming an Architect: School Web Page Design Made Simple

Charlanne Pook, Workshop

Adapting Instruction and Curriculum for Video Teleconferencing

Charlanne Pook, Technology Training/Staff Development

Student Technology Leaders: Empowering Our Students to Empower Us

Melissa Poole, Technology Training/Staff Development

Technology Infrastructure in Teacher Education

Harvey Pressman, Curriculum Design/Strategies

Integrating Technology Into All the Classrooms: A National Challenge

Cynthia Pride, Workshop

Patterns, Probability, and Problem Solving With Spreadsheets

Cynthia Pride, Laptops

My Students All Have Laptops: Now What?

Dolores Pusins, Workshop

Using Microsoft Office to Author Web Pages

June Ramondetta, Technology Training/Staff Development

Staff Development at the Center of Change

Susan Ramp Ridout, Technology Training/Staff Development

You Can Teach "Old Dogs" Without Wielding "Big Sticks"

Mary Ann Rechtfertig, Poster Session

Making Classroom Technology Integration Easier: Lesson Plans That Work

David Reider, Curriculum Design/Strategies

Memphis Kids 'n' Blues: An Arts-Based, Cross-Disciplinary, Multischool Collaborative Model

Ron Revere, Workshop

The Newest Multimedia for the Internet

Elizabeth Ridgway, Curriculum Design/Strategies

Making It Work: The Hypertext Dance in Everyday Classrooms

Margaret Riel, Technology Leadership

More Voices From the Global Village

Susan Rose, Curriculum Design/Strategies

AccuNet/AP Photo Library: Internet Access to Associate Press Photographs

Patricia Rucker, Workshop

Art and Technology Not an Oxymoron

Mark Samis, Emerging Technologies

Build Your Intranet With Web-Enabled Databases

Cathleen Sanders, Workshop

Geometry and the World Wide Web: A Feast for the Senses

Kathleen Sanders, Curriculum Design/Strategies

JEFF TECH: Integration + Inclusion + Technology = Achievement

Mark Schlager, Technology Training/Staff Development

TAPPED IN: A Testbed for New Models of Online Teacher Professional Development

Kathleen Schrock, Technology Training/Staff Development

Effective Search Strategies: How to Find It on the Net

Stephen Sesko, Special Needs

Promises Unfulfilled: Computers and Gifted Students

Thomas Lawrence Sewell, Workshop

Beyond Web Pages: The FrontPage Web Site

Carol Shields, Curriculum Design/Strategies

Applied Learning Projects in the Vocational Education Classroom

Eileen Skarecki, Workshop

The Internet: It's Far More Than an Encyclopedia, Mr. President!

Nancy Smith, Curriculum Design/Strategies

Clay Animation Using HyperStudio: A Really, Really Multidisciplinary Idea

Susan Smith, Poster Session

What! No Books!

Marilyn Smith-Stoner, Paper Session

Students as Mentors of Technology

Susan Smolin, Poster Session

Exploring Geometer's Sketchpad at the Elementary Level (Grades 4–6)

Gary Stager, Society Session/Technology Training/Staff Development

Logo: The Next Century—The Best of the Logo Exchange

Peggy Healy Stearns, Curriculum Design/Strategies

Co-Innovative Tools That Teach Community and Inspire Cross-Curricular Learning

Suzanne Sullivan, Technology Training/Staff Development

Technology Integration and a Teaching Credential: One Model of Preparation

Jeff Sun, Workshop

Evaluating Technology Planning and Implementation

John Sweeder, Poster Session

Melding Multiple Intelligence Theory and Educational Technology With Lesson Planning

Fern Tavalin, Internet Poster Session

The Web Exchange: Interactive Web Sharing of Multimedia Files

Kay Ann Taylor, Internet Posters/Curriculum Design/Strategies

Cinquain Creators CyberCorner: Language Arts Redesigned

Lajeane Thomas, Education Reform and Issues

National Educational Technology Standards (NETS) Project: Defining Technology Standards for Pre-K--12 Students

Lois Thornberg, Workshop

Classroom Computer Connections: Electrifying Elementary Lesson Plans and Ideas

John Tisbert, New Curriculum Designs/Strategies

Technology and Music Composition: The Road to Education Reform

Nena Torrez, Poster Session

Using HyperStudio to Create Culturally Consonant Curriculum

Kevin Treu, Society Session/K-16 Computer Science

How Can College/University Computer Science Departments Support K-12 Computing?

Joanne Troutner, New Curriculum Designs/Strategies

Fifty Ways to Successful Internet Staff Development

Darlene Tschudy, Workshop

Teaching Computer Skills in a Curriculum Context

Harry Tuttle, Workshop

Improving Your Videoconferencing to Maximize Student Learning

Harry Tuttle, Workshop

Transforming Elementary Activities Into Constructivist Ones Through Technology

Carol Utay, Technology Training and Staff Development

Technology Tag Team: A New Method for Training Teachers and Integrating Technology Into the Curriculum

Dorothy Valcarcel Craig, Paper Session

Learner in Charge: Student Inquiry and Technological Literacy

Judy Vesel, Curriculum Design/Strategies

The Kids Network Supplements: 21st-Century Science in the Classroom

Richard Wanderman, Special Needs

The AlphaSmart Pro Keyboard and Students and Adults With Learning Disabilities

Richard Wanderman, Special Needs

More Ways to Use an AlphaSmart Keyboard

Douglas Ward, Emerging Technologies

Zebu: Turning Your Computer Network Into a Learning Environment

Michael Waugh, Curriculum Design Strategies

The Technology Competencies Database: Distributed Teaching, Assessment, and Portfolio Management

Kathleen Webb, Technology Training/Staff Development

Utah Technology Awareness Project

Jan Wee, Workshop

From A to Z: Designing Effective Instructional Technology Plans

Carol Wells, Educational Reform and Issues

The Louisiana Challenge: A Systemic Model to Enhance Student Achievement by Networking Underserved Communities

Gail West, Spotlight Session

State of the States: NCATE/ISTE Foundation Standards for Teacher Education

Keith Wetzel, Technology Training/Staff Development

A Report on a Three-Year, School-Based Inservice Project

Mary Whyte, Workshop

Kid Pix Activities Across the Curriculum

Christina Wilder, Poster Session

Technology Resources in Elementary/Middle School Astronomy Education

Paola Williams, Workshop

Physical Places, Virtual Spaces

Anne Winchester, Exhibitor Session/Technology Training/Staff Development

Creating a Mentor Program for Your School or District: Infuse and Enthuse

Elaine Wrenn, Curriculum Design/Strategies

Using the Arts as a Springboard for Integrating Technology Into Curriculum

Peter Wright, Poster Session

A Multimedia Approach to Teaching Kinematics

Steve Yuen, Internet Poster Session

Steve Yuen's Ultimate Search Page

Workshop

Creating Digital Portfolios

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Key Words: digital portfolios, electronic portfolios, assessment, authentic assessment, Portfolio Builder, PowerPoint

In this workshop participants will get hands-on experience in putting together a digital portfolio to be used as an authentic assessment tool to document student progress and achievement. Portfolios are gaining popularity as an assessment alternative to report cards and transcripts. Several states now require schools to keep portfolios of their students' academic work in order to get a more detailed picture of student progress.

Portfolio development has become an important part of the school reform movement. The problem is that paper-based portfolios consume too much storage space and are not facile at exhibiting multimedia-based work samples. Digitizing the student's work makes it more accessible and easier to store, but the problem has been it has taken too much time and effort to compile the portfolio.

Certainly, portfolios are a very good way to document a student's development of creative and technical writing skills, but they can be used in so many other ways. With the multimedia capabilities of today's computers, digital portfolios can be used to showcase artwork, models, musical performances, speeches, presentations, athletic performances, community service, and even students' feelings and thoughts.

During the workshop the speaker will provide some background on what goes into a digital portfolio, why they are valuable, some of their uses and limitations, and how to create one. A comparison of several different software options for portfolio construction will be shown, as well as a detailed look at the new Portfolio Builder template that the speaker developed.

The Portfolio Builder is a template for Microsoft PowerPoint 97 that gives students of all ages the tools necessary to build a portfolio of their work by combining sound, video, graphics, text, and animation to create a powerful multimedia representation of their efforts. It provides templates to help students design and produce their own portfolios. It also allows students to view sample portfolios to gain insight into portfolio design.

One unique aspect of the program is that it is geared to have students, not teachers, create the portfolios. It includes templates for elementary, middle school, and high school students. The portfolios are linked to assessment screens for use by teachers, parents, and administrators. The digital portfolio can be viewed on either a Windows or Macintosh computer. PowerPoint 97's Export to HTML function also gives students and schools the ability to easily display portfolios as Web pages.

Donald Graves (Portfolio Portraits) has commented that portfolios can be a used as a teaching tool:

> *Portfolios are simply too good an idea to be limited to an evaluation instrument. Early data that show their use as a medium for instruction is more than promising .... The portfolio movement promises one of the best opportunities for students to learn how to examine their own work and participate in the entire literacy/learning process .... Our race to use portfolios with large populations runs the risk of bypassing the participation of the people most vital to its success: teachers and students.*

General Session: Society Session/Curriculum Design/Strategies

Rising to the Challenge

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Key Words: interactive multimedia, distance learning, degree programs

HyperSIG is dedicated to hypermedia and multimedia studies in education and training. This session will present software examples of interactive multimedia applications that exemplify the best in teaching and learning. All the software was developed as part of a graduate course in courseware design and development.

There is widespread agreement that one of the principal factors now limiting the extensive and effective use of technology within American schools is the relative dearth of high-quality software and digital content designed specifically for that purpose (Panel on Educational Technology, 1997). A major cause of all the low-quality software is that teaching and learning are interactive processes; learners are not buckets to be filled with knowledge. Attractive screens, even with video and audio added to text and pictures, do not constitute instruction. Every effective teacher knows that no matter how thoroughly a lesson is prepared, a certain amount of modification is needed during lesson implementation. Educational software must rise to the challenge of being sufficiently "intelligent" to provide modification of delivery based upon learner input to the product.

The work presented for discussion is all prototype. It represents team products that were created using several different instructional system design (ISD) models. Research findings in subject matter, pedagogy or andragogy, teaching methodology, multimedia design, and human-computer interface were built into the design in addition to goals, performance objectives, and assessment procedures. The software developed reflects the planning elements. Alpha-testing for accuracy of language, contents, and navigation was conducted by peers. Beta-testing for functionality and appropriateness for the narrowly defined target audience was conducted by members of that target audience. Plans for modification were developed, but implementation of the modifications were not required for the course.

Work will be presented from a variety of media and will cover many different subject areas and grades, including workplace training. The developers hope to present and discuss their work. The session coordinators will present and discuss the work of authors who are not able to attend NECC '98.

The Impact of Distance Teaching on College Faculty

Speaking about business, Gerstner (Lorek, 1997) said, "The traditional notions of distribution are being turned on their heads. Some companies will exist only on the Net." Schooling also is undergoing major shifts from building-based learning to Web-based programs and credit courses. Articles abound that address savings in terms of physical campuses and class sizes. Major misconceptions exist concerning the roles of faculty in these new learning venues.

In the excitement surrounding telecommunications and distance learning, little attention has been focused upon the impact of the new delivery paradigms on the delivery agents. The School of Computer and Information Science (SCIS) at Nova Southeastern University (NSU) pioneered computer-based distance graduate education in 1986 with its "electronic classroom" (ECR). This text-based, real-time, interactive, virtual classroom made it possible for students and professor to learn together across great physical distances. Since that time, many new tools for online learning have been developed and used by the faculty and students of SCIS. This presentation will focus on the multiple roles of the distance-learning instructor and the demands on faculty time and energy.

The discussion will address the master's and doctoral programs in Computing Technology in Education (CTE), the program in which the presenters are based. Nevertheless, the content is valid for teachers involved in or projecting involvement in distance education across all subjects and grades. The master's program, MCTE, comprises 12, three-credit courses delivered totally online. The doctoral program, DCTE, requires that students meet with professors on-campus, as a full class, for approximately 20 hours for each three-credit course. Admission to DCTE is post-masters and encompasses eight 5-month courses, four project courses, and a dissertation. The typical student is on-campus about four weeks in three-plus years in the process of obtaining the degree.

This image- and example-supported presentation will be limited to issues directly related to faculty. Restructured courses will be displayed that emphasize a shift from knowledge received to knowledge constructed, full-class interactive Web-based forums, specific-recipient(s) communications, and e-mail. The highly touted concept of asynchronous learning will be explored from the perspective of the teacher. Manageable class size, reasonable response time, electronically submitted assignments, and fair-use policies will be discussed and redefined. Projected expectations will be examined vis-^-vis realities.

Reference

Panel on Educational Technology. (1997, March). *Report to the President on the use of technology to strengthen K–12 education in the United States.* Washington, D.C.: President's Committee of Advisors on Science and Technology, Panel on Educational Technology.

National Educational Computing Conference 1998, San Diego, CA

General Session: Curriculum Design/Strategies

The Critical Issues Forum: A Multidisciplinary Curriculum Design Integrating Computer Technology

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Key Words: curriculum theory, computer technology integration, telecommunications

The Critical Issues Forum (CIF), designed for high school students and teachers, is a multidisciplinary curriculum integrating computer technology. CIF involves teacher and student teams in seeking solutions for current real-world concerns through a collaborative, distance learning process. The teams enhance their use of computer technology by developing skills in Web page development, concept mapping, and Internet research. Participant efforts are consolidated via e-mail and a Web-based curriculum. The teams interact with electronic mentors through the Web site's question submission area and ongoing dialogue page. Student work is published on the CIF Web page, and the teams participate in a culminating multimedia activity where they produce and deliver recommendations for the current issue being studied. The CIF Program is based on a curriculum model that can be utilized for a variety of topic areas.

Curriculum Theory

Meaning is a human construction interacting with a social situation, and we are constantly defining it for ourselves. But one must remember what John Dewey warned to beware of regarding the child's point of view as "finally significant in themselves" (Dewey, 1902). Learning is the responsibility of the learner, but the teacher must guide the student into developing meaning from material and experience. That is why communication is so important, but not from a single perspective. When a person can successfully explain a body of knowledge to others, we can say that this person has properly mastered this knowledge. In describing and explaining ideas to others, we need to communicate in a way that all listeners will understand as much as possible. We must realize that each listener will understand our words differently based on the listener's previous experiences; thus, these differences need to be considered.

Curriculum must be designed so that it reflects real-life situations, especially in the area of science. So much fascinating science is at the fingertips of learners everywhere, and with the increase in affordability of technology, more and more is present in homes across America. The use of societal issues as an organizer for the science curriculum has been seen as a method of teaching science to counteract the concepts as distinct and unique disciplines of study (Hofstein & Yager, 1986).

Scientists in the real world cross over the barriers between disciplines all the time, and never operate solely in the area of science but integrate the use of language, writing, content knowledge, and application of processes.

The curriculum needs to be integrative, students need to apply their learning, and curriculum development should be "a complicated and continual process of environmental design" (Apple, 1995). There should be a multidisciplinary approach that includes the integration of subjects that should emphasize education as a process and not a product. The teacher needs to assume the role of facilitator and guide students through the curriculum. In this approach, student interests can fuel the framework for facilitating scientific concepts. As stated in Science for All Americans, "Concepts are learned best when they are encountered in a variety of ways, for that ensures that there are more opportunities for them to become embedded in a student's knowledge system" (Rutherford, 1984).

Data on teaching indicates that students don't learn science by absorbing information that has been given to them through lectures, but rather by constructing meaning out of experiences though opportunities provided by the teacher. Students tend to forget most of the facts given to them. Research-based programs give the students the ability to retain these facts by affording them the opportunity to think critically, to work through problems logically, and to make connections to the real world.

Implementation

Students and teachers apply to the program as research teams. These research teams (teachers and students) participate in a minimum of three academic-year workshops held at regional locations in New Mexico. The schools provide support to the program by providing administrative resources and participation, by encouraging the teams to share their research with the student body and the community, and by providing the students with an academic credit for completion of the program. Program quality is assured through site visits, telecommunications, workshops, benchmark assignments, and products developed by the student teams.

Evaluation

The CIF has recently undergone program evaluation and was found to be an effective approach for teacher professional development in curricular development for critical thinking and questioning. The CIF program contributed to students' ability to integrate diverse disciplinary content about science-related topics, as well as support teachers in facilitating the understanding of their students using the CIF approach (Herman et al., 1996). Networking technology in CIF has been used as an information repository and resource delivery mechanism, as well as a communication medium. All curricular materials such as digital images, lesson plans, benchmarks, and problem scenarios are shared by students and teachers via the Internet and World Wide Web. Networks have supported electronic conversations between the school and laboratory communities, as well as used to encourage student-scientist partnerships and mentorships.

Although there has been a wealth of anecdotal evidence that network-based communication and technologies were an integral part of the innovative CIF instructional model, there is little explicit assessment data to support the claim that networking technology has had an impact on learning and teaching practices in this program. This is also characteristic of leading research efforts in networked communication for distance learning. Networked technologies often fail to reform teacher practices toward more constructivist approaches despite large-scale efforts to implement networking technology in classrooms. The addition of networks to instruction commonly replicates traditional classroom practices rather than provides new modes of learning (Hawkins et al., 1996). Only recently, research studies have shown the impact of networking technologies on learning as well the role networking plays in the learning and instructional process. A recent national study shows that students with online access perform better on key information management, communication, and presentation skills (Scholastic, 1997).

Poster Session

Virtual Pittsford Web Site: Time Travel Through Our Town, and Virtual USA: Time Travel Through Our Country

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Key Words: Web site development, social studies, local history

Purpose of the Historic Pittsford Web Site

The Historic Pittsford Web site—Time Travel Through Our Town—is a project done in partnership with several groups. Its purpose is to provide students and the community at large with a virtual source for the history of the town of Pittsford as it fits into the greater scheme of the region and state. It is particularly valuable for fourth-grade students as local, regional, and state history is the focus of the social studies curriculum in New York State. Often the very best resources are those that are not in textbooks but in the homes, libraries, and businesses of the community. In addition, the topic of study is so relevant to students' lives—the concept of tracing the history of one's town via the Internet. The Pittsford Central School staff is also interested in sharing this site and learning about similar efforts in other communities so that linkages can be set up and communities can learn from each other.

Historic Pittsford Web Site Designers

The design of the Historic Pittsford Web site is a partnership of three groups. One is the Pittsford Central Schools Social Studies Standards effort, chaired by Peter Pappas, Social Studies Standards chairperson. Another is the Jefferson Road School fourth-grade parents, staff, and students. Finally, Elisabeth DeGironimo, GIS Web consultant at Phoenix Systems & Technology, has designed and produced the actual site. Students received instruction in multimedia and used sophisticated drawing programs to include art work for the site.

Historic Pittsford Web Site Development

The project originated with Peter Pappas, who through numerous contacts with Historic Pittsford and town officials, linked the fourth-grade team at Jefferson Road School with source materials and people for a school project on the history of Pittsford, entitled The Spiegel Project. After a meeting with fourth-grade staff, Elisabeth DeGironimo, Web consultant Phoenix Systems & Technology, and Peter Pappas in August 1997, the Historic Pittsford Web site project was launched.

Parents were given an initial overview of the project in October 1997. They were then assigned computer lab time periods to come to school and scan photos, maps, and pictures for the project with students. At the same time, Elisabeth DeGironimo designed the site and its structure. A database was set up to catalogue the images into the various categories. Students will be adding original material, including interviews with Pittsford officials and business people, reports, and multimedia projects.

The Historic Pittsford Web site is in a GIS format and programmed in HTML. The site has three levels:

Local—about the town of Pittsford

Region—data about the city of Rochester and Monroe County

State—data about the state of New York

Users are then able to zoom in and out of a location from the three levels and gain a perspective on the relationships among the different geographic levels.

The site also is divided into four areas within the levels:

Land—data about homes, farms, and geographical features of the respective areas

Enterprise—data about businesses in each area

Community—data about churches, schools, and other civic organizations

People—data about people at each of the levels

As with many Web sites, this one is in its genesis and will continually evolve and be under construction. Future plans call for the inclusion of aerial photos, QuickTime VR movies, and multimedia projects by students.

Virtual USA

As a result of the enthusiasm for the Virtual Pittsford project. Peter Pappas is expanding the project to include the whole United States. Entitled Virtual USA, it will be similar to Virtual Pittsford in form and have some of the same components. The project will be started in the summer of 1998 as part of a summer school program for at-risk middle school students. With the highly motivating project, it is felt that this type of student will be more readily engaged in the study of social studies.

About the Pittsford Community

Why is it important to study and share information about this area via the Internet?

Pittsford is a suburb of Rochester, New York. For generations it has been known among western New York communities for a special quality—which combines charm, country elegance, pride, and a sense of individuality, qualities that are emblematic of our country. It was the first settlement east of the Genesee in what is now Monroe County and played a pivotal role in the development of this area.

Pittsford has retained a physical identity unique among Monroe County communities. At the Four Corners area, major business structures date from about 1814, 1826, and 1886. Even before this time it was the site of several Native American villages. It first figured into history in 1687 when Marquis Denonville led a French army on an expedition against the Seneca Indians in the heart of Pittsford then known as Big Spring.

The town, founded by Israel Stone, was first called Northfield. After several other name changes, it was named Pittsford after Pittsford, Vermont, in 1812.

That Pittsford became almost instantaneously a highly prosperous community is shown by the excellent quality of many of the village buildings. With the opening of the Erie Canal, the area further prospered.

While Pittsford today is a modern, highly prosperous community, its historic roots make it a significant place to study the history of our country and is an excellent springboard to the sort of study envisioned in Virtual USA.

General Session: K-16 Computer Science

Narrowcasting the Computer Literacy Course

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Key Words: computer literacy, broadcasting

The current generation of computer literacy courses at the collegiate level are swiftly becoming outdated. The customary model fails, we think, to accommodate two significant facts: (1) the fast pace of change in the computing environment (both hardware and software), which renders hardware- and software-specific training obsolete, and (2) the extent of experience and preparation that the current generation of students brings to the classroom.

We have wrestled with these problems for a number of years and have arrived at a practical model that better serves the original goals of computer literacy for our setting. In this presentation, we will outline our approach, provide some illustrations to show how it is implemented, and offer some suggestions on how this approach might be generalized.

Promoting "literacy" means to achieve a reasonable standard of performance that is based on both knowledge and skills. But entry-level students today face a different set of challenges than those a decade ago. Many of our entering students have had previous experience with computing—both formally and informally. The word processors and spreadsheets that were "gee whiz" less than a decade ago are strictly "ho-hum" to a generation introduced to computers in primary and secondary schools. Students entering our computer literacy courses are interested in expanding their knowledge and skills. For many, the traditional training model that surveys a broad spectrum of software applications is simply not appropriate.

In spite of the fact that many have experience with using computers, we have found that most of students lack an understanding of fundamental concepts about computing. They have been trained to do specific things but do not have much understanding of what they are doing. Students often lack the ability to generalize from specific cases; consequently, they find it difficult to adapt to other circumstances. They also lack a grasp of both the potential and the limitations of practical computing. Achieving an acceptable standard of "literacy" for these students means to enhance their conceptual knowledge about computers and computing.

We have arrived at a basic set of strategies to meet the needs for both providing a better conceptual framework for our students and recognizing their differing degrees of preparations and interests. These are (a) the separation of lectures and laboratory to provide a clear demarcation between conceptual and implementation issues, and (b) specialized laboratory experiences that better account for the interests and needs of the students.

In our computer literacy classes, students attend daily lecture classes (five hours a week) and a separate weekly lab session (two hours) that is augmented by project work outside of regularly scheduled meetings. Lectures are devoted to conceptual issues; laboratories and projects are devoted to implementation. A distinct advantage of this separation has led to the development of a common core of topics and issues addressed in the lecture component of the course. The need for appropriate materials to support this end eventually resulted in writing and publishing a text that features a more conceptual treatment of these topics.

We have sought to improve the laboratory component by applying a technique borrowed from the notion of networking. Broadcasting is a popular mode of communication: the same message is transmitted to a collective audience. Broadcasting, of course, is desirable because it is economical. Most college courses use this delivery mode. The success of this method rests on the assumption that a uniform message meets the needs of the entire audience—as if "one size fits all." Point-to-point communication represents the other extreme. The message is fashioned and transmitted separately for each receiver. Pedagogically, this would correspond to tutoring. Though this approach may be highly desirable, it is simply not practical. In contrast, developments in networking technology have shown that is feasible to tailor the message for specific audiences without the need for point-to-point communications. This is the method of narrowcasting. We have attempted to embrace this mode for our computer literacy courses. In short, we have created four special versions of the course by tailoring the laboratory component to suit more specific needs and interests:

1. A general-audience literacy course: fundamental computing concepts and a broad survey of software applications (document preparation, spreadsheets, databases, image processing and graphics, Web publishing, and multimedia).

2. A literacy course for science and mathematics majors: fundamental computing concepts and a survey of software applications relevant for researchers in science and math (mathematical and statistical software, scientific visualization, databases, Web publishing, and Internet resources).

3. A literacy course for students interested in digital communications and graphic arts: fundamental computing

concepts and a survey of software applications relevant for visual and print media (desktop publishing, image processing and graphics, Web publishing and design, and multimedia production).

4. A (planned) literacy course for education majors: fundamental computing concepts and a survey of information technology for communication, managing the classroom, and delivering instructional content (document preparation, spreadsheets, databases, Web publishing, and multimedia presentation and authoring tools).

In our presentation, we will address what we believe to be the fundamental core of computing concepts for a modern form of "computing literacy." We will give illustrations of the types of laboratory experiences and projects designed for these variations. Faculty from other disciplines were consulted to help in the organization and design of laboratory and project work tailored for these audiences. Finally, we will discuss some of the lessons that we have learned in implementing this program.

General Session: Technology Training/Staff Development

Beyond Technology Integration

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Key Words: professional development, staff development, teacher training, technology integration, engaged learning, student-centered learning environment, change process

Abstract

Most technology training for educators focuses on using technology in a traditional classroom or lab setting. Teachers become familiar with how to use technology in traditional, teacher-directive lessons, as well as how to accomplish administrative duties more efficiently. This "recipe book" approach is failing because teachers are unable to transfer their newly acquired technology skills to new lessons that integrate technology as an integral part of student learning. If teachers do not develop a clear understanding about student-centered learning and how computers and other technologies should be used to facilitate a student-centered learning environment, we will see the misuse of expensive equipment and lost opportunities to meet student needs.

Professional development should be an invitation for teachers to think about how instruction can be improved so that students will be engaged in powerful learning experiences. Training should provide opportunities for teachers to experience student-centered learning, the premise being that teachers cannot simply read about this transformation in education; they must experience it.

This workshop focuses on a method for moving teachers from the traditional approach of adding technology to traditional, directive classroom instruction to adapting lessons and presentations using a variety of technology tools to create student-centered learning experiences that exemplify engaged learning. The presenters will discuss how professional development should be designed so that teachers have an opportunity to rethink how they teach. They will share techniques for moving teachers from the traditional directive teaching approach to more student-centered instructional approach harnessing the power of technology.

An Example

Teachers in the Las Virgenes Unified School District participated in a four-day institute focusing on the unique role computers can play in integrating student-centered curriculum strategies. The workshop was designed to introduce educators to a process for rethinking classroom activities when integrating technology. They experienced project-based learning in a student-centered learning environment. To gain optimum benefit from this training, participants brought their own lesson plans and learned how to enhance them with technology.

Teachers worked in collaborative groups to develop a proposal for a classroom aquarium complete with salt-water marine life. Their proposals had to include the appropriate environment to support a quality life for the inhabitants. To complete this task, teachers conducted research on marine animals and their environments. They shared their research with their peers by creating and entering the information into a database. They used the information in the database to create a spreadsheet budget for a classroom aquarium. Finally they presented a proposal to their peers in the form of a persuasive slide show presentation.

All technology skills were taught in short, 30-minute minilessons within the context of the unit. After teachers learned a new skill they applied this new knowledge to complete a portion of the project. For example, after teachers gathered information on a variety of different fish, they learned how to create a database to organize and sort the information. Each group database was shared with the whole class. They used the information in the database to create their, using a spreadsheet, for the aquarium.

Reflecting on the process—how their own learning had taken place and how technology had facilitated that learning— was as important as completing the project. Teachers kept daily journals to reflect on the progress they had made. Through this reflection they began to understand their individual learning style. At the end of each day, teachers discussed how technology was used to support student-centered learning. They also talked about how they could apply what they had learned with their own students. Teachers worked in collaborative groups to develop rubrics in two areas: content and presentation. Content was assessed for accuracy and depth of information, and the persuasive argument for their proposal. Presentation was assessed for the clarity and appearance of the presentation.

After the project was completed, teachers developed a new unit of practice. They started with a topic or lesson with which they were familiar and rewrote it using technology to support student-centered learning. They also focused on designing a lesson that was more student centered and less teacher directive. These teachers continued to meet monthly to share ideas, find support, and celebrate successes.

General Session: Curriculum Designs/Strategies

Quipus Internet Spanish Projects

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Key Words: Spanish, project, e-mail, language, communication

Learning a language is more about making yourself understood and understanding than about grammar. It should be fun and interesting. Quipus has four projects to help.

As the world becomes more globalized, it becomes increasingly important to be able to communicate adequately in more than one language. Learning a language should be fun and interesting; it should include learning about other cultures and ways of living. The Internet provides a great opportunity for communicating with students from all over the world.

Spanish is the fourth most commonly spoken language in the world. If we consider native speakers it rates third, even before English. Spanish is also the foreign language more people speak in the United States. Quipus makes it possible for students from all over the world to communicate in Spanish using e-mail with attachments that include music, pictures, and even HyperStudio stacks. In these projects—Defending the Ecology, Getting to Know the World, Living the Mexican Revolution, and Communication Is the Important Thing—students really use Spanish. Instead of learning about grammar, they practice how to make themselves understood and how to understand others, which is really far more important and what they will have to do in the future.

Introduction

Quipus is a company in Mexico that is helping schools integrate technology. We are faced with similar problems as in other parts of the world, some probably more marked because of the economic crisis we are going through: lack of funds, teacher resistance, and labs for computer classes instead of integrating technology to the curriculum.

The Internet provides a great way to show interesting results in a short time; e-mail especially is easy to use and can be cheap. With just one computer connected to the Internet, a whole class can become involved in a project. One of the difficulties that arises is the lack of Spanish projects available. Teachers in Spanish-speaking countries do not know the possibilities and are afraid to lead something new. These are some of the reasons why we started these projects. It came as a big surprise when many English-speaking schools started to join to practice Spanish, their students' second language. Our e-mail projects opened many interesting possibilities to both Spanish speakers and students learning this language.

E-Mail Projects and the Curriculum

Considering that an e-mail project should be directed by a specific teacher and for specific students, we started several years ago preparing a list of projects for the different subjects of the Mexican school curriculum. The idea was not to consider specific topics but rather the general orientation and focus of each main subject.

With the subject list in mind, we launched four projects, hoping that the teachers of the subjects we had considered would direct them.

The topics were:

- Defending the Ecology (Biology)
- Getting to Know the World (Geography)
- Living the Mexican Revolution (History)
- Communication Is the Important Thing (Second Language)

Communication Projects

We soon discovered that as communication-based projects, all of them had a very important component—the language used (in this case Spanish), especially since there were several countries participating (even if all of them had been Spanish speaking). In fact, we were surprised when several U.S. schools joined because their "Spanish as a second language" students wanted the opportunity to "talk" with native Spanish-speaking children from several regions of the world.

Multipurpose Projects

Another interesting discovery we made was that in general, since all of our projects considered integrated situations, they were multipurpose and could be used for several curriculum subjects.

In this presentation we will discuss the considerations derived from our experiences and present the possibilities of using our projects for helping Spanish students in U.S. schools.

For more information about these projects, how to join, past results, dates, and so forth, visit http://www.quipus.com.mx/.

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Poster Session

Using the Teaching With Technology Instrument for Staff Development Planning

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Key Words: technology, teachers, staff development, stages of concern, training, computers, competency

As educators involved in training teachers in technology integration we are aware of some of the difficulties of technology staff development training. Administrators are concerned that teachers do not use technology in the classroom and that the training provided does not transfer to classroom use. If training emphasized the skills teachers must learn to affect student outcomes in the classroom, the training would be more effective. The Teaching With Technology Instrument (TTI) was developed to assess teachers' knowledge and classroom usage of technology. It was validated using 155 teachers and contains 46 items grouped into three areas: writing and communication, information access and management, and construction and multimedia. Each question requires a Yes or No answer. By calculating the percentage of the number of items answered Yes, you can assess a teacher in all three areas of technology usage.

The TTI was developed to assess the types of technology training a school or school district needs to offer its teachers. It can be answered on a bubble sheet and scanned for easy interpretation. The resulting printout is a display consisting of bar charts of the responses to each of the items. An administrator analyzing the answers can turn the printout on its side and quickly see the school's needs by interpreting the bar charts. Tall bars (90%) for the Yes response indicate that most teachers possess those skills. Short bars indicate that few teachers have those skills. By identifying all the items with a low percentage of Yes responses, you can identify areas that need targeted staff development activities. The data can also be output as an ASCII file and read into a spreadsheet program.

Change carries major ramifications for schools as the use of the technology becomes more prevalent. Knowing teachers' level of knowledge of technology and how they use it in instruction will help planners provide more effective staff development activities. The TTI assesses self-reported knowledge and use of technology in the classroom, and it can easily be changed to fit the needs of your school. Using a typical bubble scan program you can use the TTI to get a school profile identifying areas where technology training is needed. Using an instrument like the TTI at your school will result in more appropriate staff development activities for teachers and a corresponding increase in the effective integration of technology into your schools.

General Session: Curriculum Design/Strategies

Using Music Videos: Humanities for the MTV Generation

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Key Words: music video, history, literature, integrated, analyze, images

Using Music Videos to Thematically Introduce an Integrated U.S. History/Literature Course, or How I Learned to Love Metallica

Web address for unit plan
http://www.aufdenspring.com/image.html

Web address for student work
http://www.aufdenspring.com/muvid.html

Stories, images, and themes are what takes the study of history out of textbooks and into the living tapestry that all of us weave with our own lives. Over the past several years, music videos have been produced that focus on these stories, images, and themes, and these videos can be used to focus students on the story in history. After presenting this unit to 11th-grade U.S. history/American literature students this year, I heard comments like, "I'll never look at music videos the same again," and "There's really a lot to think about in videos." When students realized that Metallica, Erykah Badu, Rage Against the Machine, and other groups write music that is rich with historical content, they look at both music videos and U.S. history with new eyes.

Good music videos, like good writing, are thematically organized, rich in imagery, accurate, and meaningful to individuals' lives. They can, therefore be used to teach both writing skills and historical content. To do so, I showed clips from music videos to students and taught them to analyze the videos' themes, effectiveness of images, clarity of message, political biases, accuracy, and significance. Students were encouraged to research from books, sources in the Electric Library (a subscription-based Web service that compiles a variety of source material), and sources on the Internet.

The unit plan was presented to students on Web pages. Explanation of digital delivery of curricula is a part of the presentation.

The introductory video I used to teach analysis was Billy Joel's "We Didn't Start the Fire," a video loaded with images and events from 1949 through 1989. I also used parts of a brief interview with video producers taped from MTV on how music videos are made and what goes into the imagery used to support a song's lyrics. Once the introduction was done, students worked in groups to analyze other videos from a wide variety of music genres as varied as Metallica (heavy metal) and Garth Brooks (country). They could bring their own music videos to analyze if those videos met community and district standards for decency, and if I determined that they were relevant. This is how I learned to love Metallica, who has produced a stunning video based on Dalton Trumbo's "Johnny Got His Gun." I found it ironic that without knowing about this video, I almost banned student use of it, just as Trumbo's novel about war had been banned. Nonetheless, the students' arguments prevailed, and they produced a Web page that analyzed the video and its images well, while researching both World War I and what happened to Trumbo and his novel.

End products from students took a variety of forms, mostly Web pages, but also essays, photo essays, PowerPoint presentations, and oral presentations. The essay and oral presentation were required components, and in addition to analyzing both lyrics and images, students had to research the historical events that inspired the video. From student presentations, the class considered present-day issues like the minimum wage (Van Halen, "Right Now") poverty and racism from the Dust Bowl through today (Vince Gill, "Worlds Apart"), U.S. intervention in South and Central America (Rage Against the Machine, "People of the Sun"), the Cold War (Billy Joel, "Leningrad"), the Oklahoma bombing (Garth Brooks, "The Change"), the civil rights movement in the '60s (Erykah Badu, "Next Lifetime"), and many others. Each particular event led to a broader class discussion about underlying policy and history that led to the particular events referred to in the videos. For the unit to have historical significance, the broader discussion was necessary.

Using the structure of the music videos themselves, I was able to teach students the components of essay structure: thesis statement, introductory paragraph, supporting information, and conclusion. I previewed the videos to make sure that they were structured in this way and was pleased that the good ones were.

Video clips of students researching, organizing, and presenting their assignments will be part of this session. One or more students may attend and describe how the assignment was completed.

Attendees at this session will receive handouts describing the use of music videos to evoke and describe historical themes, how teachers can obtain videos and decipher lyrics, and a videography. The pedagogy behind the lesson and an explanation of digital delivery of curriculum will be discussed.

I would like to commend the Napa Unified School District for its broad-minded acceptance of the variety of music videos used in this unit. Many districts would have shied away from Metallica and their ilk, as I did, initially.

Paper Session

Interaction of Presentation Mode and Learning Style in Computer Science

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Key Words: multimedia, learning style, Myers-Briggs, computer science

Abstract

The purpose of this study was to investigate the interaction of student learning style and presentation mode on student learning in an introduction to computer science class. The learning styles studied were sensing and intuiting, as identified by the Myers-Briggs Type Indicator. The presentation mode was either traditional lecture or hypermedia. Research has suggested that multimedia methods enhance student learning and that multimedia methods particularly enhance student learning for students with a sensing cognitive style. Therefore, it was hypothesized that students who receive multimedia instruction would perform better on examinations than students who receive traditional instruction. It was further hypothesized that students with a sensing cognitive style would benefit more from multimedia instruction than would students with an intuitive cognitive style. This study did not find a significant interaction between presentation mode (lecture or multimedia) and learning style (intuitive or sensing). Nor did it find a significant difference in posttest scores by learning style. There was, however, a significant difference in posttest scores by presentation mode, with the multimedia group doing significantly better than the control group.

Introduction

In recent years, researchers have investigated the use of multimedia in higher education in many fields, including English literature (Barnes, 1994), composition (Brown, 1994), computer science (Brown, 1988; Crosby & Stelovsky, 1995), sociology (Jacobson & Spiro, 1993), English as a Second Language (Liu & Reed, 1995), business law (Quade, 1993) and photography (Shih & Alessi, 1996). In using multimedia, teachers integrate text, graphics, animation, and other media into one package. Teachers can choose the best media to explain a given topic—for example, a dynamic process may be best understood by viewing an animation (Crosby & Stelovsky, 1995). At the current time little is known about the relative effectiveness of multimedia in the classroom; therefore, it is important that researchers determine whether multimedia presentations have advantages relative to traditional teaching methods.

Of particular interest is the value of multimedia instruction for students having different learning styles. There is some evidence that multimedia presentation is especially useful for students with a sensing learning style (Crosby & Stelovsky, 1995). Research has shown that people with a sensing learning style learn through practical experience and repetition, while people with an intuitive learning style prefer learning abstract concepts and are bored with repetition (Keirsey & Bates, 1984). Since multimedia offers the possibility of illustrating abstract concepts with concrete visual examples and also provides opportunities for embedded exercises with feedback that students can do at their own pace, multimedia may be especially valuable to students with a sensing learning style.

Statement of the Problem

The purpose of this study was to investigate the interaction of student learning style and presentation mode on student learning in an introduction to computer science class. For the purpose of this study, student learning style consisted of two learning styles identified by the Myers-Briggs type indicator: sensing and intuiting. Presentation mode was either traditional lecture or hypermedia presentation. Student learning was operationally defined as the score on a test given after the presentation.

Review of Related Literature

Multimedia system designers can create learning environments that promote the active, personal exploration of information for both comprehension and information locating and retrieval (Welsh, 1995). In a multimedia environment, logically and semantically related information can be linked together to form a network (Liu & Reed, 1995). Multimedia can be used to demonstrate complicated processes in a highly interactive, animated fashion (Brown, 1988; Borning & Duisberg, 1986). Students can see, in a natural and intuitive way, how the instructional material connects with other related information (Crosby & Stelovsky, 1995).

Some researchers think that multimedia knowledge structures are similar to how the human memory system stores information. The user can "jump around" within a program—that is, access more detailed information if desired or access a graphic display of information or access totally unrelated information (Reed & Rosenbluth, 1992). Multimedia systems can be a tool that lets learners construct their own knowledge bases by making meaningful connections among the ideas they perceive (Liu & Reed, 1995). People assemble knowledge by examining ideas from different perspectives and in different contexts (Barnes, 1994). Within multimedia, hypertext and video sources combine in ways that students can impose their own framework on a complex and ill-structured domain. For that reason, Jacobson and Spiro (1993) view hypertext systems as very suitable for representing complex knowledge.

The research on hypermedia in higher education is still in the very early stages. The work of Reed and Rosenbluth (1992) and Lieu and Reed (1995) shows that students do learn using multimedia documents. Other researchers have found significant differences in student learning when the use of multimedia is contrasted with more traditional teaching methods (Barnes, 1994). Crosby and Stelovsky (1995) found significant differences between an experimental group that used hypermedia and a control group that used traditional teaching methods; the differences were particularly strong among a subgroup of learners who had a learning style (determined using the Myers-Briggs Type Indicator) that was not addressed as well using traditional methods.

The Myers-Briggs Type Indicator categorizes cognitive styles on the basis of a set of test scores received on four separate preference dimensions. One dimension preference is how students receive information (sensing or intuitive). A sensing student prefers concrete presentations and many examples of how rules and principles are applied, while an intuitive student prefers abstract presentations and is bored with repetition (Myers 1962; Lawrence, 1984).

Keirsey and Bates (1984) have noted that the distribution of people with different cognitive styles is not uniform among different professions or academic majors. For example, in computer science, Crosby and Stelovsky (1995) have found that students with a sensing cognitive style outnumber intuitive students in introductory classes, but students with an intuitive learning style are in the majority in upper-level classes. They have observed that a substantial percentage of computer science majors fail to pass introductory courses—it may be that the methods used in computer science education, primarily lecture, do not benefit students with sensing cognitive styles. Their research has indicated that current teaching styles in computer science favor intuitive students, while sensing students improve dramatically under multimedia instruction.

This research is consistent with other research that has demonstrated that individual differences in personality and learning style affect learning. Cognitive styles have been used in many studies to differentiate how people perform in various academic fields (Crosby & Stelovsky, 1995). Schurr and Ruble (1986) suggest that personality tests are correlated with differences in grades of students with similar intelligence and aptitude. Pinto and Geiger (1991) found that students' learning preferences were relatively stable. A study of computer-based instruction by Hofmann, Waters, and Berry (1981) indicates that personality traits were the most important contributor to learning. There has been some computer science education research in the area of individual variation. It has been shown that some students learn more successfully with specific types of representation (Merrill, 1987). Vincente, Hayes, and Willeges (1986) have found that user abilities, such as spatial visualization, can affect learning in computer environments. Kelly (1993) discovered considerable individual variation among student users of hypertext systems.

Statement of the Hypothesis

Research has suggested that multimedia methods enhance student learning and that multimedia methods particularly enhance student learning for students with a sensing cognitive style. Therefore, it is hypothesized that students who receive multimedia instruction will perform better on examinations than students who receive traditional instruction. It is further hypothesized that students with a sensing cognitive style will benefit more from multimedia instruction than will students with an intuitive cognitive style.

Subjects

The sample for this study consisted of 32 undergraduate students enrolled in two

Introduction to Computer Science classes at the College of Saint Rose, a liberal arts college in Albany, New York. The subjects ranged in age from 18 to 27 and represented diverse ethnicity. Sixty percent of the subjects were female. The majority of subjects were not computer science majors. The subjects were divided into two groups (sensing and intuiting) determined by their learning style as measured by the Myers-Briggs Type Indicator. There were 16 students in each group. Nine subjects from each group were randomly assigned to a multimedia presentation (the experimental group); the other seven subjects from each group were assigned to a traditional lecture (the control group). It is quite possible that the subject pool was not adequate to find a significant interaction between presentation method and learning style.

Instrument

There were two instruments used in this study. The Myers Briggs Type Indicator was used to categorize learning styles on the basis of test scores on four dimensions. The four dimensions are an individual's exploratory attitude toward the environment (judging or perceiving), the individual's social interactions (introvert or extrovert), how the individual prefers to receive information (sensing or intuitive), and how the individual processes information (thinking or feeling). For the purposes of this study, the only score of interest was whether subjects were sensing or intuitive.

The other instrument was developed to test knowledge of Boolean operations and circuits. Two independent experts in computer science education, who indicated that it was a valid test of knowledge in this subject area, reviewed this instrument. The instrument consisted of 10 1-point short-answer questions on Boolean expression evaluation, 16 1-point short answer questions on circuits, and 5 2-point questions that required construction of a circuit from a Boolean expression. The 1-point questions were graded as either correct or incorrect (1 or 0 points per question). Students received full credit for the 2-point questions if the circuit was completely correct, half credit if the circuit had one error, and no credit otherwise (2, 1, or 0 points per questions). The sum of the scores on all the questions determined the score for knowledge in the subject area.

Experimental Design

The experimenter chose the posttest-only, control-group design (see Figure 1). The two independent variables were learning style and method of instruction. The dependent variable was knowledge of subject matter from the lesson on computer circuits.

Subjects were assigned to an odd-numbered or even-numbered group based upon their learning style (sensing or intuitive) as measured by the Myers-Briggs Type Indicator; the treatment students received was randomly determined. This design was chosen because it controls for many sources of invalidity and because random assignment to groups was feasible. Mortality, a potential threat to this design, proved not to be a problem, as no subjects dropped out of the study.

Group	Assignment	n	Treatment	Posttest
1	Sensing; Random	7	Lecture	Learning Measure
2	Intuitive; Random	7	Lecture	Learning Measure
3	Sensing; Random	9	Multimedia Lesson	Learning Measure
4	Intuitive; Random	9	Multimedia Lesson	Learning Measure

Figure 1. Experimental design

Procedure

Thirty-two undergraduate students enrolled in two Introduction to Computer Science classes at the College of Saint Rose were administered the Myers-Briggs Type Indicator to determine whether they had sensing or intuitive learning styles. Sixteen of these students had the sensing learning style, and half had the intuitive learning style. Nine of the "sensing" subjects and nine of the "intuitive" subjects were randomly assigned to a multimedia presentation on computer circuits (the experimental group); the other subjects were assigned to a traditional lecture (the control group).

The treatment was a lesson on computer circuits. Subjects had previously learned about Boolean expressions, but computer circuits had not yet been covered in class. Both the control and experimental treatments lasted exactly 50 minutes. The control group's lecture contained the same factual material as the experimental group's multimedia presentation. The only difference was the medium of instruction. The lecturer of the control group created the multimedia presentation. The multimedia presentation included text, hotwords, drill-and-practice exercises, animations of functioning circuits, animations to show how computer circuits are constructed, and opportunities for students to build their own circuits. The lecture included verbal explanation of the material, questions posed to students, examples drawn on a whiteboard showing how computer circuits function, and examples drawn on a whiteboard showing how computer circuits are constructed. During either treatment, subjects could ask questions of the instructor. After the treatment, both groups were administered an examination, which consisted of short-answer questions on Boolean expressions and computer circuits, and longer questions where students had to build computer circuits.

Results

A two-way analysis of variance was used to analyze the data. The two fixed, categorical, independent variables were learning style (sensing and intuitive) and presentation method (lecture and multimedia). The continuous, random, dependent variable was posttest score. Table 1 presents the means and standard deviations for the study. Table 2 summarizes the analysis of variance.

Examination of Table 2 indicates that there was not a significant two-way interaction ($F = 0.48$; $df = 1,28$; $p > .05$) between learning style and presentation method. Nor was there a significant difference by learning style (F = 1.58; df = 1,28; p > .05). However, there was a significant difference by presentation method (F = 10.83; df = 1,28; p < .05). Posttest scores for the multimedia group (mean = 30.44) were greater than posttest scores for the lecture group (mean = 22.71). Overall, eta squared strength of association indicated that 26.5% of the variability in posttest score could be accounted for by the presentation method.

Table 1. Means and Standard Deviations for Presentation Method by Learning Style

			Learning Style	
			Intuitive	**Sensing**
Presentation Method	Multimedia	mean sd n	31.111 5.776 9	29.778 7.645 9
	Lecture	mean sd n	25.000 7.326 7	20.429 5.159 7

Table 2. Analysis of Variance for Posttest Score on Presentation Method by Learning Style

Source	SS	df	MS	F
Presentation Method	470.57	1	470.57	10.83*
Learning Style	68.64	1	68.64	1.58
Presentation Method x Learning Style	20.64	1	20.64	0.48
Error	1216.16	28	43.43	

* p < .05

Discussion

This study did not find a significant interaction between presentation mode (lecture or multimedia) and learning style (intuitive or sensing). Nor did it find a significant difference in posttest scores by learning style. There was, however, a significant difference in posttest scores by presentation mode, with the multimedia group doing significantly better than the control group.

It appears that students of both learning styles benefit from multimedia instruction. It is quite possible that different aspects of the multimedia lesson helped different types of students. As the researcher anticipated, sensing students benefited from being able to see the animations of abstract concepts. Sensing students were also helped by the repetitive drill-and-practice exercises. But the self-paced nature of the multimedia lesson may have been more effective for intuitive students, as they could continue with the lesson as soon as they understood a concept (and proved to themselves that they could apply the concept) rather than have to wait for their slower sensing classmates to get it. This would help prevent boredom and loss of focus among these students. Although time on task was not measured in this experiment, the researcher did observe that intuitive students tended to finish the lesson in less time than sensing students.

Although there was no significant interaction between presentation mode and learning style, it was noted that there was a smaller difference in mean posttest scores between the two learning styles groups who had the multimedia lesson. Since the sample size was only adequate to yield a power of .54, repeating the study with a larger sample size may be warranted.

It may also be interesting to see if there are differences between learning style groups in time on task in a multimedia lesson. This would verify the assumption that sensing students appreciate the repetitive and animating features of the lesson, while intuitive students appreciate the ability to work faster. Such a study could also examine any interaction between time on task and learning style—it appeared to the researcher that those intuitive students who spent the least time doing the multimedia lesson did worse than intuitive students who took a moderate amount of time to finish. It would also be interesting to see whether there are differences in liking different features of the multimedia lesson among students of different learning styles.

In summary, we note that students who used a multimedia lesson on computer science did significantly better than students who studied the same concepts using traditional methods. The implication of this finding is that computer science students would benefit if their instructors would either create or find such materials for them. In recent years, some computer science departments, such as Carnegie Mellon and George Washington University, have made such materials available free on the World Wide Web. Organizations such as the ACM's Special Interest Group on Computer Science Education have also started to collect animations relating to computer science education. Commercial products of this nature are now available on CD-ROMs. It is important that computer science education researchers study the effectiveness of such products and whether they benefit certain students especially.

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General Session: Exhibitor Session/Emerging Technologies

IBM Learning Village: Maximizing the Home/School Connections

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Key Words: technology, Internet, K–12, home-school, communications, collaboration, involvement

Abstract

Both research and common sense tell us that parental and community involvement is a critical factor for success at school. We are at a point where a number of technological innovations are converging to make technology-based home/school/community connections a reality. This presentation will describe the IBM Learning Village technology. This technology utilizes the power of the Web to connect homes, schools, and communities to help foster an environment of involvement, information sharing, and collaboration.

The IBM Learning Village is based on software technology tested through the IBM Reinventing Education Grant "Wired for Learning" project in the Charlotte-Mecklenburg School District. IBM used both Lotus Domino and Java to create an application in which the Internet is used to create a team learning environment for parents, teachers, students, and the entire community. Teachers are given new tools to reach out to families, and parents can quickly and easily understand what assignments their children are completing on a daily basis. Collaboration among students and teachers in a secured environment is also provided.

Because the application is Web based, users can access the application from any location that has Internet access via a supported browser. This presentation will show how using the IBM Learning Village allows users to do the following:

- Teachers and families can access a variety of communication tools anytime, at their convenience.
- Parents can view homework assignments, their child's completed work, and teacher evaluations of their child's progress all available during and after school hours.
- Online, private conversations can be held between teachers and parents, teachers and students, and teachers and teachers.
- Family and community members can access a wide range

of school news, from lunch menus to events calendars.

- Approved mentors and tutors can participate in online discussions with students and teachers.

- Projects can be accessed from home, providing an extended school day with more opportunity for parental guidance and involvement.

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Poster Session

National Geographic Kids Network Transforms Classroom Learning With Internet-Based Technology and Hands-On Science

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Key Words: science, geography, telecommunications, Internet, elementary, middle school, environmental science

The National Geographic Kids Network is a telecommunications-based science and geography curriculum for Grades 3–9. The network is designed to foster the spirit of discovery and to encourage students to investigate new ideas by allowing them to conduct original research into scientific topics of geographic and social significance.

NGS Kids Network provides a distinct format for students to investigate and assess a wide range of topics. Applicable curriculum areas include but are not limited to geography, science, social studies, mathematics, and language arts. The learning process for students is enhanced by participating in four distinct steps: gathering data and other information, analyzing and assessing the information, designing investigations of their own by consulting resources in their library or community, and by reporting and sharing their conclusions.

Students are taught organizational skills using the calendar and word processor. Collaboration and teamwork are encouraged. A plan for investigation is formulated, and students soon learn the value of grouping information. Examples of how information can be grouped include numerically by using the data notebook or by graphing, grouping that is text based using the word processor, or visually grouping information using the map maker and stamper or painter. Reporting may be in the form of written or oral reports, posters, newsletters, poetry, or art work to illustrate ideas. Students see technology as a tool and become actively involved in the learning process. Activities can be adapted equally well for the one-computer classroom or for the technology lab.

Telecommunications is an integral part of every unit. Activities in each unit require the transmission of letters, data files, visual images, and maps through the telecommunications network. Students use the computer to record data, create graphs, plot data on maps, report their finds, illustrate their ideas, and exchange information with their global partners. A unit scientist provides suggestions for each team.

Available units for Grades 3–7 include Hello!, Acid Rain, Weather in Action, What's in Our Water?, Too Much Trash?, What Are We Eating?, and Solar Energy. Units available for Grades 6–9 are How Loud Is Too Loud?, Are We Getting Enough Oxygen?, Is Our Water at Risk?, and What Is Our Soil Good For?

Each curriculum unit of NGS Kids Network includes NGS Works software, an NGS Kids Network curriculum unit, test kits for the unit chosen, an eight-week tuition membership that best fits your schedule, a full set of guides for classroom projects and activities, and a complete teachers guide. Many curriculum ideas will be shared during the session, and teachers will find NGS Kids Network can be easily incorporated to enhance existing curriculum. This powerful, user-friendly software runs on Macintosh or Windows computers.

Poster Session

Incorporating Technology With Native American Studies in the Elementary Classroom

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Key Words: PowerPoint, Storybook Weaver, Adobe Premiere

A unit on North American Indians has been part of the second-grade social studies curriculum for many years. All realms of Native American culture are explored. One section of this unit is on the Makah, a Northwest Coast tribe. Recently we have incorporated various aspects of technology to enhance this unit on Native Americans and address the different learning styles of our children. We will demonstrate three main uses of technology in our Makah study. We will show how to put together a PowerPoint presentation, use Storybook Weaver to create reports, and use Adobe Premiere to enhance videotape.

A PowerPoint presentation is used to introduce the Makah culture to the children. This easy-to-use program incorporates text and images from digital cameras or a scanner. Many of these images are scanned pictures, photographs, drawings, and even calendars and postcards gathered at last year's conference in Seattle. This presentation builds interest and provides visual reinforcement of the main concepts of the unit.

The students use the Storybook Weaver Program to create their reports on each Native American group studied. This program is simple enough for younger children to use, yet has wonderful graphics that appeal to the older children. Pictures and text combine to present what they have learned about each Native American culture. The reports are printed and bound together in book form.

The second graders learn how Native Americans passed down their beliefs through legends. Upper school students, 11th graders from a multimedia design class, videotape the lower school students sitting in a circle wearing their capes retelling the Makah legends. Adobe Premiere, a digital program, is used to create a short nine-minute movie including edited versions of the legends, sound, credits, titles, and transitions. At the closing party, the Potlatch, the students view the video, presented to the lower school students as a surprise gift.

Poster Session

Writing for a Real Audience: Foreign Language Students' Web Publications

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Key Words: World Wide Web, Spanish, writing, publication, activities

"Why do I have to study a foreign language? I'm never going to use it" is a complaint commonly heard from university students when they see their general education requirements. The World Wide Web offers an opportunity to change that attitude. Not only does the Web give students access to native language materials but also provides a venue for them to use the target language with native speakers with whom they would not normally have contact. This access motivates students, broadens their perspectives on the world, and demonstrates in undeniable terms the multilingual reality of the "global village." This session thus focuses on third-semester Spanish students' online writing for personal home pages, news reports, and chat rooms, providing a description of these three activities, instructions given to students, and examples of their results.

Throughout one semester, 18 students created and expanded on their personal home pages beginning with a model home page containing examples of different fonts, sizes, lists, and pictures that individuals modified to fit their own preferences. This system minimized the amount of technical skills students needed yet left them the flexibility to use their creativity with language and graphic design.

The personal home pages housed links to students' contributions to a class newspaper covering cultural, political, and social aspects of the Hispanic world, both in and out of the United States. Using guidelines provided by the instructor, students chose three areas in which to write articles about current events. Some of the alternatives included articles on world news, sports, movie and music reviews, and live interviews with native Spanish speakers. These articles replaced the typical compositions assigned throughout a language class. The articles were written by the students and linked to their home pages, as well as to a page for the newspaper's front page.

While the first two activities permitted students to carefully plan what they wrote, their participation in chat rooms did not. Students met native speakers in Spanish-language chat rooms and conversed with them in writing. They were able to choose between several chat sites and rooms from a list of available sites provided by the instructor. This technology challenged students with more spontaneous interactions and offered them the opportunity to meet the potential online audience of their other works on an individual basis, communicate with them, and reinforce their awareness of Spanish as a real, viable language.

Attendees at this session will gain ideas for using the Web for any class, instructions for students, and information on the time commitment required for incorporating technology in useful and realistic ways in the foreign language curriculum. They will also have an example to take back to their home institutions of a project that brings the "real world" into the classroom through technology.

Workshop

Letting the Curriculum Drive the Classroom Use of Technology: A Model for Professional Development

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New York City—D24, PS81, Teacher Trainer

Key Words: collaboration, creativity, curriculum, integrate, model, process, support

This preconference workshop will provide an overview of how teachers can integrate technology into their curricula in innovative ways through participation in on-going professional development activities.

Through a collaborative effort of the United Federation of Teachers/New York City Teacher Centers Consortium and the New York State Model Schools Program, six teachers from four schools in various geographic and demographic areas of New York City working with a team of professional developers engaged in innovating and exploring the use of technology through a research-based technology integration process.

This presentation will illustrate the creativity, diversity, and collaborative spirit of the teachers and their classes reflected in projects across the curriculum from Grades pre-K–6.

Projects

Title of Project 1: The Grouchy Ladybug Slide show (P.S.197 Kindergarten)
Title of Project 2: The Civil War Database (P.S.183 Grade 2 Gifted)

Teacher: Vinna M. Garcia
Grade(s): K & 2
School: Public School 183 and Public School 197—Far Rockaway in Community School District 27–Queens, New York

Software and Hardware
Project 1: 1 Macintosh LC, 1 Color StyleWriter 2500, Kid Pix 2
Project 2: 1 Macintosh 5400, 2 Macintosh LC 580, Color StyleWriter, FileMaker Pro 3.0, Kid Pix Studio

Title of Project: The Multilingual Multimedia Welcome Map (P.S.62—Grade 6)

Teachers: Linda Norwich and Rita Olino
Grade(s): 6
School: Public School 62—Richmond Hill in Community School District 27 Queens, New York

Hardware and Software
2 Power Macintosh 5400, 1 Power Macintosh 5260, 1 QuickTake Camera, 1 Apple Scanner, 1 disposable camera and HyperStudio

Title of Project: The Rain Forest Telecommunications Project

Teacher: Charline Leland and Anna Giudice
Grade(s): 3, 4 &5
School: Public School 81—Ridgewood in Community School District 24 Queens, New York

Software and Hardware
1 Macintosh 5200, Mac LC 3 lab 1 AOL Account, PageMill

Title of Project: First Steps

Teacher: Donna Yung-Chan
Grade(s): Pre-K
School: Public School 1 in Community School District 2 New York, New York

Hardware and Software
1 Macintosh LC 5200, Millie's Math House, Thinkin' Things, Kid Pix

General Session: ISTE Society Session/Curriculum Design/Strategies

Implementing Schoolwide Reform Through Community Support and a National Network

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Key Words: community, constructivist, research, exchange, survey, network, scaling-up

The National School Network (NSN) is a collaboration that now includes more than 300 of the schools on the leading edge of LAN-based high-speed Internet connectivity and nearly 150 other organizations, including leading school districts, content suppliers, and organizations with technical expertise. Together, this national network, including the schools themselves, is supporting member schools' successful implementations of telecommunications-based instructional programs. The premise of the NSN is that if schools can become contributors and partners in knowledge advancement and community problem-solving, taxpayers, governments, and private industry will view these benefits as warranting the investment needed to support schools' technology efforts on a large scale.

This presentation will highlight four aspects of the National School Network's activities:

- developing effective two-way synergistic investments between schools and their local communities
- sharing expertise and assistance among schools across the network and major content providers and technical experts in ways that help accomplish important instructional reforms
- broadening Internet participation and constructivist-oriented instruction among the many teachers of each school
- research on the conditions facilitating accomplishment of those three objectives

School-Community Investments: This presentation by Melanie Goldman of GTE Internetworking/BBN describes what NSN schools do for their communities and how communities invest in NSN schools. Many NSN schools have been leaders in enabling other local institutions, from government agencies to nonprofit service organizations, to have an Internet presence. Now, NSN is facilitating local community involvement in school instructional objectives through projects such as Mentor Center telementoring services. Through continued mutual support, the NSN will demonstrate the value of community investments in school technology infrastructures.

Expertise-Sharing Among NSN Schools and Support Organizations: This presentation by Gail Pierson of GTE Internetworking/BBN describes how the network works to help each school attain its objectives through innovative uses of the Internet. The presentation discusses the NSN Exchange, which is the electronic meeting place for all NSN members, who are active, key contributors and publishers of information, points of view, and new curricular and technical resources for their network partners. Live Internet events organized and run by NSN members provide models of resource sharing and good instructional practice for other member schools.

Scaling Up Participation Within NSN Schools: This presentation, by Beverly Hunter of GTE Internetworking/BBN, discusses strategies that NSN schools and support organizations are following to spread technical expertise and effective participation in network activities among the diverse teachers within a given building. One direction currently being followed, based on feedback from member sites, is to fashion Internet-using curriculum materials to make them more suitable for teachers with varying levels of technical expertise. Other directions include support for new student roles, assessment of student learning, linking learning activities to new curriculum standards, providing support for teachers' publishing their experiences, and engaging participation in the NSN by a broader range of stakeholders.

Research on Conditions for Success: This presentation by Henry Jay Becker, University of California, Irvine, and Jason Ravitz, GTE/BBN, addresses this question: "Which factors differentiate schools that have moved furthest toward the three objectives above (community investment, participation in the school network community, and broadened involvement by teachers at the school level): (a) technological infrastructure, e.g., how much connectivity?; (b) school-level leadership and investment in training and support, i.e., how much and what types?; or (c) teacher attributes, e.g., technical skills, pedagogical beliefs, and motivations to change?"

Poster Session

Water Resources: A Statewide Collaborative Challenge

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Key Words: water, collaborative project, lesson plans, Challenge Grant

Lesson plans authored by Margaret Henderson, Linda Breaux, Margaret Curette, and Litton Nugent.

Water Resources: A Louisiana Legacy

If one had to choose a "signature" theme for Louisiana, it would have to be water. It was logical to select this poignant theme for the first statewide collaborative project of the Louisiana Challenge Grant Project.

Research and Development

The Louisiana Challenge Grant involves five school districts that are widely scattered across the state, but participants had not had a chance to meet each other or work together as a cohesive group. Thus, a statewide conference was held to introduce the collaborative telecommunications project in which students would pursue all aspects of water's powerful impact on the people of the state.

Guidelines and sample collaborative projects had already been developed and posted in the Educational Resources section of the Louisiana Challenge Homepage (http://www.challenge.state.la.us/k12act/collab/index.html). Serious research was begun for sites that could serve as resources for the study.

Systemic Planning

Curriculum and technology experts met to design the basic unit, objectives, and four lesson themes. Then a complete resource unit was written, including student worksheets and online submission and evaluation forms. Lead teachers and a project team leader were selected, provided with inservice training, and asked to write lesson plans. A project timeline was also adopted.

Promotional Ideas

At the statewide conference, the Water theme prevailed, and all attendees were invited to provide ideas and to participate. Site facilitators visited classrooms and encouraged teachers to participate.

Implementation

A project team leader was chosen to monitor the project and collect and report data. All teachers were given e-mail accounts to facilitate correspondence and sharing of data and ideas. The curriculum specialist and Web master developed specialized worksheets, submission forms, and effective means of reporting data and student products online. This was a particularly difficult area that literally evolved as the project progressed. Information was collected about such things as e-mailing multimedia programs and showing them online; using digital cameras and scanners; submitting graphs, charts, and timelines electronically; and incorporating process as well as product measurements of student learning.

Review and Evaluation

Though reports and evaluations are not complete at this time, many successes as well as lessons learned are already evident. The administrative structure has worked well, with lead teachers supported by the project team leader, site facilitators, and the central administrative staff. The project evaluation, when completed, will reveal teacher and student perceptions of the amounts of engaged learning, knowledge of content, whether higher level thinking skills were used, types of technology skills learned by students, how attitudes toward Louisiana's water resources have changed, and how many teachers and students were impacted.

Online Resources for Project Assistance

The complete resource unit with lesson plans, student worksheets, submission forms, links to online resources, evaluations, and student reports is available at http://www.challenge.state.la.us/.

General Session: Technology Leadership

The ABCs of a Statewide Framework for Instructional Technology Success

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Key Words: technology plans, instructional technology, technical architecture, teacher competencies, student computer skills, reform

The whole is greater than the sum of its parts. Learn how the ABCs—architecture, best practices, and competencies—equal enterprise-oriented schools capable of supporting 21st-century students.

This presentation will describe the North Carolina initiatives in instructional technology that comprise a statewide framework for instructional technology implementation in the public schools. Using experiences from two years of statewide implementation of district instructional technology plans, the presenters will discuss the benefits and the details of having a state technology plan integrated with the state's technical architecture, educator technology competencies required for license, and student computer skills.

Architecture: The North Carolina Technical Architecture provides guidelines for the structured configuration and implementation of information infrastructures and application development. These guidelines provide schools with the ability to develop LANs, WANs, and Internet access in keeping with industry standards and in conjunction with other public agencies. Interoperability, connectivity, and ease of use are thereby incorporated into each school's technology environment.

This session will discuss the concept of a statewide integrated information network designed to provide universal access to information and to facilitate productivity. A comparison of the benefits and responsibilities inherent in a tiered model for interoperability will be provided.

Best Practices: As result of the statewide instructional technology initiative, North Carolina has developed an array of best practices in both technology implementation and instructional strategies. The best practices from industry and other government entities are monitored and reviewed in order to share with the school systems. Successful instructional practices from North Carolina school systems as well as from other states are collected and disseminated for collaborative use.

The concept of using standard methodologies for developing and implementing instructional technology plans has provided a sound foundation and established credibility with business partners. The session will discuss the various interactions between educators and community supporters, between school systems and other public agencies, and among school districts and institutions of higher education. A video of a model school of technology integration will be shown.

Competencies: Since 1995, North Carolina educators have been required to acquire technology competencies as part of their license renewal process. These competencies correlate to the student computer skills mandated for high school graduation. Teachers and students thereby have the competencies necessary to make use of the information resources made available by the technology initiatives.

The session will provide information on programs to enhance the mandated student computer skills as well as initiatives to progress into advanced skill sets and job-readiness certifications. The accountability model used to document the individual student achievement of the mandated computer skills will be discussed. The session will also describe the self-assessment tools and staff development models for teachers to use in satisfying the license renewal requirement of three to five renewal units on the technology competencies.

The session will include highlights of district plans, success stories, examples of collaboration, and benefits of coordinated planning. Materials will be shared on the teacher technology competencies, student computer skills, available resources, and the technical architecture.

Web sites:
http://www.dpi.state.nc.us/
http://www.state.nc.us/irm/

General Session: Curriculum Design/Strategies

World Wide Web - Online Graduate Educational Technology Courses

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Key Words: instructional design, online course, Internet course, Internet instruction, curriculum design, World Wide Web instruction

This session will examine the course design, instructional material development, and lessons learned from two years of offering online graduate educational technology courses. It will show you how to design an online course, build the instructional materials, and make the most of the advantages of Internet instruction while avoiding potential problems.

The session is based on two courses that have been designed and offered by Lesley College—ECOMP 6101, Technology and Its Impact on Society and Schools, and ECOMP 5016, Teaching and Learning With Multimedia. Both seek to meet three goals. First, they are designed to provide graduate educational technology courses to distant learners. Second, they are intended to provide both deliberative and technical skill content. Third, they model the use of the Internet as a course delivery medium.

Five key adaptations of existing courses developed during this project will be shared. To assist prospective students in determining whether online study would be possible and/or appropriate, a "readiness check" brochure and associated online "tool check" site have been developed. The course syllabi have been adapted to create weekly "benchmark" assignments that help students stay up to date with course work. Course assignments have been adapted for Internet compatibility, encouraging the use of Internet collaboration and resources. An online discussion forum has been established to foster the interchange of student and instructor thoughts and ideas. A communication and coordination protocol has also been developed to improve student advising and evaluation.

A core set of materials provided to all online students has been developed for each course. These include a common text and set of readings, a library of shareware and/or licensed software tools, and video tutorials on the use of these tools and associated peripheral devices. These materials will be demonstrated; and the selection and production processes used, including video and CD production methods, will be presented.

Most importantly, some essential lessons concerning online course delivery will be considered. Evidence gathered from several years of comparative investigation of the similarities and differences between the same courses offered in different formats will be presented. Foremost among the findings is that online learning works: students produce comparable learning products. We have also found that participating students report overall satisfaction with online learning, acknowledging the tradeoffs while still finding them acceptable. We have found that the syllabus structure is critical to course progress. There is also an associated need to adhere to the planned course of action because the time delays in communicating changes are very difficult to overcome. Students report that the tutorial materials are essential to their success. Video modeling of technical skills is clearly necessary for many learners for whom text-based instructions do not "give them the picture." Online discussion is more thoughtful and less spontaneous than its face-to-face counterpart. Delays between individual contributions to discussion topics inhibits spontaneity and leads to fewer, but more in-depth and thoughtful, postings on the discussion forum. Significantly, the locus of control shifts toward the student. The limitations of mediated interchange between instructor and student necessitate that the teacher develop broad expectation guidelines within which student interpretation is permitted broad leeway.

General Session: Teacher Training/Staff Development

Training Science Teachers With a CD-ROM and a World Wide Web Support Network

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Key Words: science education, preservice teachers, inservice teachers, Web forum, instructional technology, CD-ROM, World Wide Web

This session will demonstrate a method for helping science teachers use a CD-ROM with a World Wide Web support network to incorporate technology competencies into their curricula.

To address the problems that science teachers have with incorporating technology competency skills in secondary educational settings, we have compiled an Instructional Materials for Science Educators (IMSE) CD-ROM and have created IMSEnet, a support network for science teachers on the World Wide Web. The IMSE CD-ROM is used in conjunction with IMSEnet to provide training for preservice and inservice science teachers at North Carolina State University to incorporate a variety of existing instructional technologies into their curricula. The IMSE CD-ROM was used as a primary resource in our preservice science teacher materials course offered by the Department of Mathematics, Science and Technology Education, in fall, 1997; a series of workshops offered at NCSU's Science House; and at other professional development sessions for science educators.

The IMSE CD-ROM contains a variety of instructional science resources, including science-content Web sites, Internet tutorials, science software, video clips, and CBL and MBL laboratories. The IMSE CD-ROM and IMSEnet serve as resource tools to facilitate the development of technology competency skills for our preservice and inservice science teachers. In addition, the incorporation of new and existing technology into teaching is modeled by providing templates that show the use of instructional technology resources in the classroom. Preservice and inservice teachers learn to enhance their present science curriculum by using the IMSE CD-ROM as a gateway to connect them to information that is accessible only on the World Wide Web. As an overview of science on the World Wide Web, the IMSE CD-ROM contains lesson templates and lists of science Web resources that enable an easier integration of online materials into science teaching.

IMSEnet also contains the SciTeach Web Forum. This forum is a place where science teachers can share ideas, reflections, and conversations on teaching and implementation of technology in the classroom, while also providing support for each other as members of an electronic professional community.

This session will demonstrate how the IMSE CD-ROM and IMSEnet can be used as tools to incorporate technology competencies into instruction and classroom activities for preservice and inservice science teachers.

Related URLs:

IMSEnet
http://www.ncsu.edu/imse/

SciTeach Web Forum
http://www.forum.ncsu.edu/sciteach/

Science education staff development workshops
http://www2.ncsu.edu/unity/lockers/project/scijunct/imse/lowres/2/imseteach.

Workshop

Developing a Web Site With FrontPage 97 and Access 97

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Key Words: Web site, database access, site management, Web page development

Focus of the Session

Participants in this workshop will use top-rated Web site development tools from Microsoft (FrontPage 97 and Access 97) to learn how to develop interactive, dynamic Web sites. Web sites today are more frequently customized for each user by accessing components and data from database information. The techniques and procedures for using such database data is critical to maintaining an up-to-date Web site and providing information specific to the viewer's needs and interests.

Activities

The morning session will center on the development of Web pages and a Web site using FrontPage 97. This software, running on either Windows 95 or Windows NT, provides an easy-to-use environment for developing both Web pages and Web sites. Understanding how to use these creation tools together will be emphasized. The session will deal with the following topics:

- Review of HTML Basics
- The FrontPage Explorer and Editor
- Building Your Web Page
- Linking Pages Within the Web Site
- A Hands-On Web Site Design Project
- Managing Your Web Site With FrontPage

The afternoon session will walk participants through the use of Microsoft Access 97 database files to provide data specific to a viewer's request. Access 97, a relational database, provides an entry-level environment with which to implement initial databased sites that may be expanded to more robust database systems at a later time. The afternoon session will deal with the following topic:

- Developing a FrontPage Form Using the Form Wizard
- The Mysteries of ODBC, ISAPI & SQL for the Rest of Us
- Using IDC/HTX With Microsoft's Personal Web Server on Windows 95
- A Hands-On Web Database Project
- Guiding Principles: KISS

Other topics will relate to the transfer of your Web site developed offline to your production Web server (Windows NT, UNIX, etc.). Suggested procedures for checking new material and schedules for updating your Web site will also be shared. Issues of how to manage the development process offline and then upload the Web periodically to the production Web server will be discussed.

Overall, the emphasis will be on developing a Web site that is both interactive but reasonable to maintain. Tips from on-the-job experience of developing a large Web site using these tools will be shared with participants.

General Session: Curriculum Design/Strategies

Supporting Videoconferencing With Web-Based Tutorials

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Key Words: Web-based instruction, videoconferencing, tutorials, Web-based collaboration, distance learning

Focus of the Session

This session addresses the need to evaluate Web page design in order to determine how to effectively deliver content over the World Wide Web. The need for such a delivery system becomes apparent when viewed in the context of distance learning paradigms, especially for students remote from the origin of the instructional session. The Web offers an opportunity to provide not only personalized follow up but also a setting for delivering reinforcing instructional materials and tutorials.

The present session seeks to explore some of the attempts we have made to implement some of these ideas as well as to study some of the issues that make for effective Web page delivery.

Determining What Constitutes an Effective Web Page

We have been simulating the variables normally associated with Web page effectiveness on a single computer. We have investigated how we can vary the type of connection (through variable rates of response), Web page complexity (through measures of graphic complexity, presence or absence of animation, etc.), the format of presentation (frames vs. no frames). Our methodologies allow serious Web page designers and content developers to evaluate their Web pages to refine both student skills and student learning through appropriate time on task, attending to the relevant parts of the display, and so forth. While still preliminary, some of these results will be shared with the audience.

Controlling the Delivery of Web Pages

- Page design using FrontPage 97
- Selection of appropriate graphic formats and preparations
- Focusing attention through Web page elements
- Scripting the delivery with Visual InterDev
- Delivering tutorial content through the Web browser
- Storing progress in a database

Web-Based Tutorial Development

- Selecting the authoring software
- Delivering cross-platform tutorials
- Format: HTML or Java?
- Mapping out the scope and sequence of the tutorials
- Deploying the Web pages to the student population

Other Topics

- Hardware configuration for the development station(s)
- Finding/developing the graphics needed to get your point across
- Moving from the lab to the Web (for real)

In addition, we will discuss the reaction of students to participating in a class taught at multiple sites through the use of PictureTel videoconferencing systems. Some of the techniques used will be shared, especially those that were received positively by the participating students. The use of the Web and Web-based tutorials and/or discussion groups have met with success and seem to have provided a less “sterile” atmosphere.

Transferring the Strategy

The presenters will share the keys to successful Web page design strategies based upon their experience. The training, student support, and extension of these techniques to broad student populations and educational levels will also be addressed. Special attention will be given to the deployment in the general college curriculum.

Spotlight Session

Technology Staff Development: A Different Angle

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Key Words: staff development, adult learners, change, assessment, standards, professional development, information literacy

A staff development plan that embraces a variety of learning opportunities based on individual learning plans is the most effective design for teachers to transfer the use of technology to their classrooms. How do you develop a plan for technology if teachers don't know what they don't know? In developing a program for your staff, you need to spend some time gathering information on who they are and what they want. This session is targeted to change agents, administrators, technology coordinators, board members, computer teachers, or anyone interested in seeing change happen in education and at their school or district.

You have offered countless classes on technology. You have brought in the experts, and the evaluations were great. So why are teachers still having difficulty transferring what they learned to the classroom? Just imagine learning a new concept in one day and then being asked to transfer what you learned to your teaching strategies. Staff development days are isolated, covering too much too fast, which for many teachers is too difficult to digest. Their heads are swimming. You need a plan for staff development where all teachers provide input and feel that they have been heard.

We need to consider reaching the different learning styles and the multiple intelligences of adults as well as our students. In this presentation, we will review background information on adult learners and what staff developers need to know to be successful. Adults learn differently than children because adults bring a highly developed set of beliefs about what is and what is not appropriate in a given situation. Teachers do things that work for them. If teachers seem resistant to using technology, any staff development program needs to take into consideration this information on adult learners and the slow process of change in education. Any technology use has to be relevant to what the teachers are doing or plan to do with their students. With all that we know now, it is important to include in staff development an understanding of standards (which may or may not be defined as of yet), strategies for assessment and accountability, and content along with new pedagogy. This takes time. In developing an effective staff development plan, you need to:

> 1. Ask your teachers for input on what they would like to learn. Survey and interview them on their needs, their frustrations, their fears, their hopes on what they want to learn, and their dreams and goals for their students. One survey could be based on information in the personal proficiency matrix, and the results of the survey can be used in designing staff development opportunities. We will share how we did this with several schools and districts. You may also be able to identify your mentors or coaches from these results.
>
> 2. Develop a matrix on specific skills that teachers can refer to. You can also use a rubric where teachers can identify how they feel about using different technologies. Both of these can be scored, and results can be used in identifying next steps or ongoing strategies as their needs change. In this presentation we will share a rubric designed around ISTE's Performance Content Standards.
>
> 3. Help your teachers design Individual Learning Plans from the data collected from the surveys, interviews, and rubrics. Have them determine where they are now—their level of proficiency for each technology area. Then have them look at short-range goals—pick five areas where they would like to see improvement by the end of the school year. Ask each teacher to give input on the five areas they would like staff development on.
>
> 4. Prioritize needs by grade level or subject areas and proficiency levels from each teacher's results. This can be done at a faculty or department meetings with all teachers so that they feel they have been heard. Look at possible school-wide themes or problems that could be developed. Include the technology committee, any providers, outside experts, and support staff when planning and designing staff development for the year. Use individual and whole-faculty responses to see what you can offer onsite and offsite.
>
> 5. Look at possible solutions for on-going, hands-on sessions where teachers are given release time in small, focused groups or in peer-coaching. (There is funding if you look for it—businesses spend more than 30% of their technology budgets on training.)
>
> 6. Look for classes and conferences for teachers to attend. Give them some incentives (i.e., district credit or computers to check out or zero-interest loans) to learn. Teachers are

professionals and should be valued as such. Yet, teachers also need to take responsibility for their own professional growth. Emphasize the importance of lifelong learning.

7. Encourage team teaching and collaborative planning time so that teachers do not feel they have to be an expert in everything. (Buddy systems work well with teachers also.) Mentoring can also work within the staff and from students. (Look for student experts—yes, we can learn from them.) Some schools are using techno-buddies from the business world. Your community is unique. You never know who is there unless you go out and look.

8. Include time for brainstorming, sharing, and developing materials. Technology can become a catalyst for school change and restructuring. Teaching changes when you use technology, and teachers need to have support from the school if things do not work out the way they wanted.

9. Realize that for every hour of a workshop, it takes more than two hours of planning. If you do not have time for teachers to plan, do not expect the workshop to be as successful. If you do not have the time but have the money, spend it on someone who can do the job. Teachers do not have time to waste.

10. Continue with on-going planning and re-evaluating of where you are and where you want to be. After you start using technology, needs change.

We will also share a new approach in attaining information and technology literacy. Many teachers have taken classes and mastered certain software programs, yet still do not see how they can transfer this information to the classroom and their students. Using information literacy strategies (what do I want to know?), teachers will be able to ask a pertinent question related to content and use technology and traditional methods to find information. Technology is a tool not for its sake alone. We start with a task, e.g., e-mail, where everyone in the school is given an e-mail account and is part of a listserv. Learn by doing! As part of the plan, teachers have computers with access to the Internet and specific software at school and at home. (This could be part of a zero-interest loan program or check-out system.) They have to have access to reach literacy. They also have to have time to experiment and communicate. All along the way provide mentors and coaches via release time to help those who need it. Continue to offer incentives (money and college credit) for workshops off-site. Have teachers decide on a problem (it could be a problem that involves the school or one related to the curriculum or grade level) that they can tackle collaboratively. Then give them some places to research the problem on the Internet, with software, articles, or books. Deciding on a problem may take time and may be revisited after information is found. Provide a day to pull them together with their collected data to share and evaluate what they have found. Using flowcharts (these could be generated by software or Post-its), have them plan together how they will tackle this problem—who will do what by when. From the teachers' needs, they will decide how they will present their findings. Some will need more workshops on spreadsheets to learn how to graph their data. Some will want to spend more time with desktop publishing or Web authoring. This is the time to give them workshops, release time, or the opportunity to see other sites. Have them refer to their personal proficiency matrix and update it. Have them share their project with other teachers who can evaluate it on effectiveness and provide constructive feedback. As part of the assessment, have teachers develop a portfolio of their work and findings. When they are ready, they will want to share their findings at a faculty meeting or board meeting. They have a real need now and can see where technology might fit. Along the way, share the importance of ethics and equity, citing information and copyright concerns as part of your listserv or Web site. Keeping information flowing is the key. Showing that everyone's information is important to solving the problem creates excitement and ownership. This model can now be replicated in the classroom if and when teachers feel they can do it themselves.

Plan for staff development and communicate about how long this will take. Teachers get frustrated when they do not see results right away. This approach takes planning and time, but if you work toward information and technology literacy, it will create a feeling of "we can do it!" over and over again.

Our session will be in a PowerPoint presentation. Expect a fun, entertaining, and interactive session where the participants will walk away not only with some information to take back to their staff but also with the motivation to start using what they have learned.

General Session: Curriculum Design/Strategies

QuickTime VR and Internet Production of Student Resources

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Key Words: QuickTime VR, virtual reality, Internet, Web site, curriculum resources, student resources, North Carolina

The Instructional Technology Division at the North Carolina Department of Public Instruction created two Internet Web sites providing classroom resources for North Carolina students. The goal of the sites is to present students with opportunities to use the Internet to support the computer skills and social studies curriculums through Internet-based, virtual reality visits to state government, historical, and natural resources. The session covers the planning/production process used in setting up the Web sites. The photographic and digital production equipment and software used to create the QuickTime Virtual Reality movies and other content is discussed in detail. While the content of this site is specific to North Carolina, the process of developing a similar site is applicable to any location.

The two Web sites featured in the session are Virtual Visits and Carolina Clips. The first site, Virtual Visits (http://www.ipti.dpi.state.nc.us/vvisits/), presents a virtual reality field-trip to Raleigh, North Carolina. The site's backpack logo echoes the virtual traveler theme. Clicking on the backpack's patches link users to the site's content. The Visits patch offers students an opportunity to explore the State Capitol, Legislative Building, Executive Mansion, Education Building, Natural Sciences Museum, Museum of History, Mordecai Plantation, and the Capital Area Visitor Center. At each site, an opening screen shows an establishing photograph of the location, a list of areas or rooms available for further exploration, and a short text passage about the site. From the main location screen, users can view maps or virtual reality movies. The QTVR movies allow students to use the cursor to tilt up and down and to pan in either direction to see a continuous 360-degree panorama of the site. The QTVR movies include places such as the governor's office and other sites where students are not generally admitted. An Introductory/Help page gives information about software needed to view virtual reality movies and links to Web sites where these free programs can be obtained for Windows or Macintosh computers.

The second site, Carolina Clips (http://www.itpi.dpi.state.nc.us/caroclips/), is a digital collection of North Carolina photographs and facts. The site is divided into three main categories: Lighthouses, Raleigh, and Waterfalls. The three locations have similar screen formats. Lighthouses highlights lighthouses on the coast of North Carolina. A map of the coast displays the location of each lighthouse. Clicking on a lighthouse icon on the map links users to a photograph of the lighthouse, a more detailed map of its location, facts (taken from the Computer Skills Lesson Plan databases), and a short historical overview of the lighthouse. Clicking on the photograph and the maps display larger versions that can be copied for use in student projects and reports. Raleigh presents a map of downtown Raleigh's state government complex. Students can click on the Executive Mansion, State Capitol, and Legislative Building for collections of photographs, current and historical, of these sites. Sites for the Education Building and the Museums of History and Natural Science are currently under construction. Views from the roofs of the Education Building and the 29th story of the First Union Bank Building provide bird's-eye views of the Government Mall. Waterfalls takes students to the western part of the state to view the natural beauty of the many waterfalls found there. Counties who provide photographs, facts, and descriptions of their waterfalls will be included on the site. So far, 10 North Carolina counties are included: Wilkes, Watauga, Avery, Burke, Rutherford, Polk, Transylvania, Haywood, Jackson, and Macon. Plans for expanding the site to include links to sites across the United States and to consolidate historical sites across North Carolina are under development.

All images used in the sites are copyright cleared, and students are granted permission to use data, text, and pictures in their reports and projects with proper attribution. A Guide to Documenting Pictures/Text, located on both sites, offers students and teachers guidance in assigning attribution. Future plans include the release of a CD-ROM version for Windows and Macintosh.

Poster Session

Survey of HyperStudio Animation

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Key Words: animation, multimedia, graphics, HyperStudio

Of all the features in the multimedia program HyperStudio, animation is one of the most powerful. The actor-based animation in the current versions includes a vast array of options, limited only by the imagination. This truly empowering technique gives students and teachers a wonderful new creative tool, and it is very easy to learn. But the sheer number of choices on the two animation dialogs can be somewhat overwhelming. This poster session clarifies all the options in a logical order, demonstrating the effects of each. It also includes many examples of these options applied to finished stacks. The results are spectacular! After seeing what is possible with this easy-to-learn system, attendees will be excited and confident about tackling animation for themselves.

The session includes the basics of animation and a discussion of art sources for animation, including numbered screens, capturing from the stack, and GIF animations. It clarifies the distinction between animation graphics, clip art, and graphic objects, and explains how these relate to exported screens and GIF animations. It demonstrates the array of options for this new type of animation, including the use of a transparent color to hide the rectangular area around the actor, how to use the clones option to run the same animation several times simultaneously, and the difference between actor motion and path motion.

An extensive set of examples puts all these different possibilities in context and shows such extensions of the basic process as linking animations together. Also included is a brief look at alternatives to regular animation-card transitions, Ghostwriter, Hide-Show NBA, and HyperLogo. Almost all these examples are cross-platform, but the few differences between the Windows and Mac versions will be discussed as they are encountered.

Workshop

Hands-On HyperStudio Animation, From A to Zoom!

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Key Words: animation, multimedia, graphics, HyperStudio

Actor-based animation, one of the most powerful features of HyperStudio, includes options limited only by the imagination, and it's very easy to learn. This empowering technique gives students and teachers a wonderful creative tool. Teachers will get a great sense of accomplishment from this workshop, which they can pass on to their students, who immediately experiment with further projects.

Attendees cover the entire array of options within this three-hour, intensive, hands-on, advanced workshop. Techniques are cross-platform. Attendees must have mastered simple stack creation, basic use of the paint and editing tools, and adding clip art and backgrounds.

We begin with basic principles of animation; the distinctions between clip art, graphic objects, and animation graphics in HyperStudio animation; and the differences between exported screens, a current screen selection, and GIF as animation source. Thereafter attendees create their own animation stacks. The first project involves frame movement only. Projects gradually become more complex. Students prepare a series of actor frames with original art, export them, and use them for animation with both frame and path movement. Some ability with the paint tools is needed, but attendees do not need to be artists! One of the key points in the workshop is that classroom students can create animation entirely "from scratch," using their own original artwork.

We also take a single art clip, change it to produce several poses, position them, and export these screens for the animation source. This also requires some facility with the paint tools. The point is to use clip art collections as starting points for original projects. Finally, we use the GIF animations provided with HyperStudio. These are introduced after students are accustomed to preparing their own art, so they will not fall into the habit of using only these premade examples.

Then we edit the animation buttons. We adjust and coordinate actor and path speed, experiment with continuously running animations, and use clones, reverse paths, and loop paths. We edit the path and create a new path using the same actor. Conversely, we get a new actor but retain the same path. Eventually, we try out all the options in the dialog boxes at least once.

Depending on student level, we create more complex animations. We will certainly have animations running in front of a background and interacting with HyperStudio objects such as text fields, buttons, and graphic objects. For example, we use graphic objects as foreground objects to create virtual scenes. We may also work with special types of actor-based animation, such as autodrawing, and dynamic graphs.

Workshop

Multimedia, Java, and HTML With Digital Chisel 3

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Key Words: Java, HTML, Digital Chisel 3, multimedia

Java gives users the power to enliven Web pages. Digital Chisel 3 simplifies the creation of projects for school and the Internet, and is useful in Grades 4 and up.

Escalating expectations, demanding students, and accelerating change are forcing schools to re-evaluate how they use technology. In this environment, educators must seek new ways to reach students, involve parents, and maintain high academic standards. Schools need tools as flexible as their changing needs, and Pierian Spring Software has created the necessary cornerstone—Digital Chisel 3—that will enable educators and students to communicate, collaborate, and connect in ways previously unimaginable.

Students can create and publish great-looking multimedia projects and interactive Web pages to share their skills and creativity. Teachers can give exams over their local network or the Internet and compile the responses and scores in the database of their choice. They can customize the look and functionality of the toolbars for different ages and skill levels. Learners will build Java simulations, models, experiments, games, puzzles, and multimedia effects and embed them in their pages.

At the conclusion of this workshop, participants will be able to do the following:

- Outline and storyboard a successful Web page to achieve an educational objective
- Obtain information from recommended or self-selected sites on the World Wide Web, including, but not limited to, graphics, animated graphics, and data
- Author an educationally valid Web page with interactive elements (i.e., clickable objects and triggers that play sounds)
- Post a completed Web page to a server for viewing by the general World Wide Web audience
- Explain the educational applicability of Web pages for individual and group uses

This hands-on workshop will give you an opportunity to use the authoring and editing capabilities of Digital Chisel 3 to develop interactive pages that can be used on stand-alone computers, network computers, school intranets, or the World Wide Web itself. To help speed up project development, you will be given a recommended list of educationally valid topics and kid-safe resources (URLs) from which to draw information. Brainstorming, outlining, and storyboarding will follow, with an eye toward producing a project of approximately four pages. You will then use the integrated, Java-capable Web browser in Digital Chisel 3 to do online research. We will access a CD-ROM for additional graphic resources and digital cameras to add pictures to your pages. After the projects have been completed, we will post them to a universally available Web site for viewing by any conference attendees who wish to visit them.

Spotlight Session

Supporting Your School's Curriculum: Your Dream Elementary Classroom

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Key Words: classroom, computers, elementary, learning, change, software, labs

> *I have one computer in my room, a Power Mac 5200, which I use for word processing. If the library computers are available, we might make special visits, but there are classes there most of the time. Students use the lab setup once a week.*
>
> *Fifth-grade teacher, Metuchen, New Jersey*

This teacher's statement reflects the experiences of teachers in schools across the country.

Structurally, elementary classrooms are more similar than different—30 x 30-foot cement block spaces—with two power outlets, 22 to 28 desks, tables, a blackboard, shelves, and bulletin boards. Most of the schools' computers are found in labs, under the strict control of a computer coordinator. These labs are often like minicomputer museums, with a collection of old and sometimes new computers, printers, monitors, and so on. Most classroom teachers feel lucky if they have even one up-to-date computer, and a telephone connection for Internet access is rare.

What Do Teachers Want?

We surveyed a group of elementary teachers to determine what they would do with technology in their classrooms if money were no object. All responded enthusiastically about using computers to support each subject. Many of the teachers told us that to use technology more effectively, they would need several computers in their rooms, not down the hall in a lab. They felt that technology could then be used on a more regular basis and consequently could be an integral part of the curriculum. They also told us that when it comes to computers, more is definitely better. The optimal number of classroom computers, these teachers believed, is between three and five. With several computers, small groups of students could work at the machines simultaneously. That number of machines would also help teachers make the most of all the available reference, tutorial, word processing, and Internet functions computers have to offer. In addition to using the computer for student research and writing, teachers said they'd use their dream system to make multimedia presentations and to reinforce basic concepts and facts from the subjects of math, reading, and writing. The bottom line—teachers want technology in their classrooms, but they also want control of it, with the emphasis on supporting their teaching.

Take This to Your School Board: A $9,000 Technology-Enhanced Classroom

Based on the teachers' ideas of optimal classroom computing, we went shopping in regular catalogs and computer outlet stores, and were able to put together a complete and ideal classroom technology center for less than $9,000. This four-computer center covers the essentials: Internet access, technical support, color printing, a starter bundle of software, late-model 200 MHz computers, and the ability to show VHS videotapes and support classroom presentations.

Designed for typical preschool through middle school self-contained classrooms, the technology center will give kids and teachers computer access whenever they want it and will facilitate the integration of technology into all areas of the school curriculum.

The Setup

Here is what our budget would provide, along with a recommended configuration:

• Four Mac or Windows computers: e.g., four Gateway 2000 G5-200 MMX Pentium 200 MHz computers, 33.6 fax/modems, 16 MB RAM, 15-inch monitors, 12x CD-ROM drives ($1,800 each); or Power Macintosh 5400/180 16 MB RAM, 1.6 GB hard disk ($1,800 each). (Total expense: $7,200.)

• Put these computers on low 6- or 8-foot tables. (Get these from the storage room and have the custodian take about 6 inches off of the legs for the lower grades.) Put the monitors facing outward from the center of the classroom so that everyone can see the screen. Plug everything into one switchable, surge-protected powerstrip ($50) mounted under one of the tables.

• Plug one of the computers into an HP 690 series Inkjet printer ($300) to serve as a printing station. For about $100 extra in cables, you can hook all the computers into the printer.

• Hook up to the Internet. If your classroom has a local phone line and your school is not already paying for Internet access (most schools are), here's a shortcut. Simply subscribe to America Online for 10-month unlimited Internet access ($199.50/year).

• Acquire a presentation system. Get one Zenith 27" presentation TV with a built-in scan converter ($759), and a VCR ($190) for showing videos. This will give you the ability to do computer demonstrations the whole class can see.

- Purchase software. Select seven or eight programs ($200) that match your curriculum goals.

Total = $8,999.50 per room

What Do You Think?

Clearly, there are many ways to use computers in classrooms. We put forward this model as a beginning of a conversation about what can be done using off-the-shelf computers and software in traditional classroom settings. The "dream classroom" we propose here puts the weight of responsibility directly on the shoulders of the teacher and will work if the teacher and students are intrinsically interested in making the software and browsers work. They'll need to learn how to handle the typical bugs that occur with software installation, and will need access to a range of the best software programs available. An article describing this "dream classroom" originally appeared in the September/October issue of Children's Software Revue and includes two illustrations for how it might look.

Internet Poster Session

Connect-2-Tomorrow, Today!

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Key Words: technology, students, training, hospital, Mississippi

Our effort to connect every classroom is just the beginning. In addition, we should connect every hospital to the Internet. We challenge the private sector to start by connecting every children's hospital as soon as possible so that a child in a hospital bed can stay in touch with school, family, and friends. A sick child need no longer be alone.

The Mississippi Department of Education, Office of Educational Technology, has been awarded a second grant from the U.S. Department of Commerce, NTIA/TIIAP. This grant will allow MDE to extend the original grant from NTIA/TIIAP, Connecting Communities (mdek12.state.ms.us/concom.htm). For the second grant, Connect-2-Tomorrow (mdek12.state.ms.us/connect), MDE will partner with the University Medical Center to provide Internet access to the Blair E. Batson Hospital for Children in Jackson, MS. Connect-2-Tomorrow will utilize high school students, Tech Crews, that were trained in the original grant to create and maintain this Internet access. The Tech Crews will once again represent each of the five Congressional districts. School Districts that plan to participate are: Greenville Public School, Winona Public School, West Jasper School District, Stone County School District, and Wilkinson County School District.

President Bill Clinton, State of the Union Address,
February 1997

The major goal of the Children's Hospital School is to provide continuity in educational programming for chronically ill children and those with debilitating acute illnesses that require frequent or lengthy hospitalizations. Connect-2-Tomorrow will provide this continuity to their educational progress, promote social development, and afford them a positive impact on their psychological well-being. The use of keypals and tutors, coordinated by the Tech Crews, will offer a glimpse to the outside world, a close friend to discuss problems and reassure them that they are never alone. The five Tech Crews will train other high school students throughout the state who organize MECA student chapters. These new Tech Crews will be trained in networking, telecommunications, and Web page development just as the original Tech Crews were. The new Tech Crews will serve as keypals and tutors to the hospital students as well as a technological resource for their school districts.

SIG/Tel Workshop

Dancin' to a Global Beat: Classrooms as International Learning Communities

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Key Words: telecomputing, educational projects, collaboration

How does one initiate a telecomputing project that involves classroom collaboration on a global scale? The rapid development of technological tools would seem to simplify matters, yet time commitments and logistical concerns remain problematic. Indeed, educational telecomputing requires the establishment of a project structure, recruitment of participants, coordination with online partners, and continual reflection on both local and global concerns. This workshop is designed to help the novice take those first tentative steps onto the dance floor of global telecomputing. As such, it will offer general guidelines, from the initial phase of envisioning a project through various concerns of design and implementation to the outcomes of telecomputing "dance" routines.

Integrating telecommunications into the curriculum changes the way students learn and teachers teach. By using collaborative online projects, students are often more motivated and self-directed in their learning. The teacher becomes a guide or facilitator of the learning that takes place, coaching and critiquing but ultimately allowing the students to dance the dance. Nevertheless, classroom management remains an essential skill, requiring careful consideration of cooperative learning environments, an understanding of available equipment, and continual attention to curricular objectives, pedagogical strategies, and individual assessment. Workshop presenters will share experiences in telecomputing to explore questions that help the uninitiated imagine stepping onto this new dance floor. Participants will examine award-winning projects and brainstorm ideas for telecomputing activities that accommodate geographically and culturally diverse dancers around the world, helping isolated classrooms forge an international learning community.

The Internet provides a vehicle for student interaction but does not ensure successful collaboration. While computer networks afford the opportunity for interaction, teachers remain critical in inspiring students, planning and supervising e-mail exchanges, and helping a community of inquiry construct knowledge and meaning.

The structure of telecomputing projects is a pre-eminent concern, and one that this workshop will address while considering how students and teachers use the technology to best advantage. By drawing upon successful classroom paradigms like "learning circles" and examining how devices such as listservs, message forums, and Web pages can assist student discourse, workshop leaders will offer insight on the intricate dance of relationships among students, teachers, and computer networks in new learning environments.

In technological terms, creating a telecommunication project is relatively easy. What needs to be addressed, however, is the role of facilitating these projects to inspire learning in the global classroom. The fact that students are communicating with their peers in the antipodes, or fellow students in adjoining school districts, often provides the necessary catalyst, but what does the teacher do when it isn't enough? Students may take interest in learning about newfound friends or describing themselves, their school, and community, but how do we move beyond the "keypal" exchange to a more vigorous and enlightening discourse? Telecommunication provides a vehicle for such exchanges and helps improve reading and writing skills among many student participants. Nevertheless, we as educators must now think beyond the "boxes and wires," the mechanics of "Dancin' to a Global Beat," to discover innovative and meaningful ways of introducing telecommunications to our classrooms.

General Session: Technology Leadership

Mandated Computer Competence: One State's Method of Compliance

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Key Words: teacher education, technology competencies, technology assessment

What happens when a state mandates computer competence for preservice teachers as a licensure requirement? How do you implement a plan to ensure compliance and a high success rate?

Background

In its commitment to integrate technology into instructional programs, the North Carolina Board of Education implemented the following initiatives:

1991	All eighth-grade students were required to pass a computer competency test for high school graduation.
1992	Computer competencies were defined for all public school educators.
1992	A computer skills curriculum was developed as part of the North Carolina Standard Course of Study.
1995	The legislature appropriated funds for instructional technology, 20% of which was to be used for staff development.
1995	Technology competencies (basic and advanced) for teacher education faculty and students were developed.
1995	Recurring funds were appropriated for an instructional technology position for each university campus (teacher education) and one-time funds were provided for technology resources (known as the Spangler Initiative, named for the president of the North Carolina university system).
1996	Public school teachers were required to take 3–5 credits in the area of technology for licensure renewal.
Spring 1999	Teacher education graduates seeking initial teacher licensure must demonstrate mastery of technology competencies (basic and advanced).

Implementation of the Spangler Initiative

The Spangler positions at each university were established to ensure that teacher education faculty gain the skills necessary to integrate technology into their own teaching. The initiative's guiding model, the "train the trainer" approach, includes the following objectives:

1. Faculty members receive the training they need to integrate and model the use of technology in their own teaching.

2. In the professional courses, faculty members model the use of technology so that students learn both the technical skills and pedagogical implications.

3. Teacher education graduates take their technology skills to their own classrooms, where they teach and model appropriate uses of technology to both their students and colleagues.

The technology competencies for educators are divided into two tiers, basic and advanced. The basic competencies include the following categories:

Computer Operation Skills

Setup, Maintenance, and Troubleshooting

Word Processing/Introductory Desktop Publishing

Spreadsheet/Graphing

Database

Networking

Telecommunications

Media Communications

Multimedia Integration

These competencies are assessed through the Essential Technology Skills Inventory (ETSI), consisting of two parts, a multiple-choice section and a performance section. The performance section requires students to produce a desktop-publishing document and create and/or modify a database and spreadsheet.

The advanced competencies focus on integrating technology into curriculum areas. These competencies include:

Curriculum

Subject-Specific Knowledge

Design and Management of Learning Environments/Resources

Child Development, Learning, and Diversity

Social, Legal, and Ethical Issues

These competencies are assessed through the development of a product-based portfolio evaluated by a team of university faculty and public school teachers. The State Department of Public Instruction (SDPI) requested that each university submit a plan (or multiple plans) for the portfolio assessment.

The plans vary greatly from campus to campus, as well as among program areas within each campus since they reflect unique differences.

As the initiative has evolved, instructional technology specialists have worked collaboratively to develop strategies for addressing issues such as:

Faculty Training

Training Opportunities for Students

Test Development (ETSI) and Administration

Development of Portfolio Plans

Funding

Although the implementation process has been ambitious, it has served as a catalyst for change. As a result, we feel confident that the instructional program in North Carolina will be strengthened by educators prepared to use technology as a tool to enhance teaching and learning.

General Session: Curriculum Design/Strategies

Creating Virtual Environments for Collaborative Learning at the Graduate Level

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Key Words: graduate education, distance learning, collaboration

This session will focus upon the experiences in two graduate settings, one in which students develop skills of collaborative learning by creating a virtual organization and the second in which students become members of a collaborative learning team in a doctoral distance learning program. The session will suggest ways to facilitate such environments and will draw upon the experiences of faculty and students in exploring both the rewards and challenges of virtual collaboration. Discussion will follow the presentation.

"The Virtual Organization" (aka, "Vorg: The First Generation") is a distance learning course in which students learn experientially. That is, they learn about virtual organizations by becoming one. In the first weeks of the Vorg, facilitators provide the students with electronic connectivity tools, a mission, and team structures. Thereafter the organization self-evolves with minimal facilitator intervention. The ensuing experience directly introduces the students to the complexities and challenges of communication and coordination in a virtual work environment. The students develop and implement procedures for decision making, task allocation, knowledge management, and project management. The resulting learning provides students with a conceptual framework and the ability to work successfully in a virtual team.

In the Transformative Learning and Change doctoral program, a cohort of learners develop a collaborative learning community and work together for a period of three years in a virtual environment designed to facilitate self-organization and group learning. The students learn and practice participative/action research strategies, along with their other studies. The curriculum is interdisciplinary, with a focus on systems theory, multiple ways of knowing, and collaborative inquiry. A culminating activity is a group demonstration of competency wherein the group develops and carries out a major collaborative project. Students convene twice a year for a residential intensive seminar to augment the virtual learning environment.

Paper Session

Online Communities as a Vehicle for Developing Secondary Mathematics Educators

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Key Words: teacher development, online communities, mathematics education, telecommunications

The potential uses of online communication in the preparation of preservice and inservice secondary mathematics teachers transcend the traditional geographic benefits of distance education. Not only can the technology provide asynchronous instruction over great distances, it may also be used to create genuine opportunities for keeping pace with rapidly the emerging content, epistemologies, and pedagogical strategies associated with contemporary mathematics. In other words, computational technology is reinventing mathematics while simultaneously increasing opportunities and raising expectations for the learning of mathematics. Mathematics educators will benefit from these technologies via the ability to personally construct mathematics, cope with the rapid pace of mathematical innovation, discuss the pedagogical issues associated with these changes within an expanded community of practice, and learn how technology may be employed to assist more students in a joyful pursuit of mathematical understanding.

This paper will offer a model for the development of online learning environments designed to prepare new teachers to teach secondary mathematics. The need for dynamic telecourses will be discussed, along with the features needed to ensure that prospective teachers not only learn new content but pedagogical strategies as well. One current online community, NetAdventure, is offered as a case study of what is currently possible.

Introduction

The potential uses of online communication in the preparation of preservice and inservice secondary mathematics teachers transcend the traditional geographic benefits of distance education. Not only can the technology provide asynchronous instruction over great distances, it also may be used to create genuine opportunities for keeping pace with rapidly emerging content, epistemologies, and pedagogical strategies associated with contemporary mathematics. In other words, computational technology is reinventing mathematics while simultaneously increasing opportunities and raising expectations for the learning of mathematics. Mathematics educators will benefit from these technologies via the ability to personally construct mathematics, cope with the rapid pace of mathematical innovation, discuss the pedagogical issues associated with these changes within an expanded community of practice, and learn how technology may be employed to assist more students in a joyful pursuit of mathematical understanding.

Online Telecourses

The increasing availability of Internet access (e-mail, newsgroups, MUDs, MOOs, the World Wide Web) makes low-cost, high-output professional development telecourses possible. In 1997 several interesting models already existed and telecourse development was underway. Robert Tinker suggests the following scenario for the future of online professional development for teachers:

> *There will be an explosion of network-based courses for teacher professional development. The best of these will offer world-class learning opportunities that will intermix cognitive research, educational philosophy, subject matter content, and just-in-time support for in-class experimentation. Participants can work with local study groups and larger virtual groups that span the world. The faculty leading these will consist of teams that include international experts, experienced teachers, and outstanding researchers. Graduate credit from leading institutions throughout the world will be available for teachers. Part of the teacher evaluation will be based on curriculum and research contributions participating teachers make and post on the network. The result will be a growing teacher-generated literature of immense value to education and increasing appreciation for the role of life-long learning for teachers and teachers who are also researchers making contributions to education, science, and mathematics.*
>
> *The availability of excellent graduate netcourses will substantially improve teacher preparation and professional development. With thousands of accredited courses available online, no teacher or prospective teacher will ever again have to suffer through a dull, meaningless course just because it is the only one available. That stuffy, old, sexist fogy, droning on from out-dated notes will have no audience. In fact, entire departments and schools of education will find themselves out of business unless they improve their teaching and scholarship, because their students will be recruited to stronger, more aggressive graduate schools throughout the world.*
>
> *(Tinker, 1997, p. 5)*

New Content, New Tools, New Ways of Knowing

Perhaps no subject of study bears as little resemblance to the discipline it intends to teach as mathematics education. The incongruity between pedagogy, content, and purposeful application occurs at a time when mathematics is changing rapidly. Mathematicians and scientists are alert to the blurring boundaries between different branches of mathematics and other disciplines, new ways of solving problems, and the increasing importance of mathematics in the social and behavioral sciences. The increasing demands of the behavioral and social sciences for reliable quantitative measurement and analysis of new types of problems not only relies on mathematics but also influences its development and teaching.

Much has been written about the societal demands for an increasingly mathematically literate population. We live in a world awash in data. Good citizenship is dependent on an ability to process often confusing and conflicting information. Economic, political, and social trends require students to have a much deeper understanding and appreciation for mathematical thinking now more than ever before. The pace of technological innovation spurs the rapid evolution of mathematics.

The NCTM Standards state that "fifty percent of all mathematics has been invented since World War II" (National Council of Teachers of Mathematics, 1989). Few if any of these branches of mathematical inquiry have found a home the K–12 curriculum. Topics such as number theory, chaos, topology, cellular automata, and fractal geometry may appeal to students unsuccessful in traditional math classes. These new areas of mathematics tend to be more contextual, visual, playful, experimental, and fascinating than the traditional emphasis on paper-and-pencil-based algebra and geometry. Technology provides an opportunity for more children to view mathematics as a powerful part of their own learning and to embrace the process of mathematical inquiry. As Papert (1980) has noted:

> *A dignified mathematics for children cannot be something we permit ourselves to inflict on children, like unpleasant medicine, although we see no reason to take it ourselves.*
> *(p. 54)*

Secondary mathematics teachers can and should explore these new mathematical domains. Prospective and practicing teachers should acquaint themselves with these new "ways of knowing" by using the actual technology that (a) led to the development of these new mathematical ideas and (b) will assist their students in the construction of personal meaning. The constructivist principle of learning through the making of connections is apparent when a teacher is using technology to learn about new mathematical knowledge that is itself the product of similar technology while thinking about how this technology might be used by students to construct understanding of a particular mathematical concept. Ongoing reflective practice and action research can play an important role in telecourses. Emerging technologies for sharing video over the Internet makes it possible to have a community of prospective educators to critique each other's teaching and even visit other classrooms.

The Concord Consortium (Tinker & Haavind, 1997) suggests that the advantages of telecourses include:

- Anytime, anywhere learning
- Asynchronous interaction
- Group collaboration
- New educational approaches
- Integration of computers

Rich online learning experiences encourage communication, community, collaboration, curiosity, courage, commitment, and common sense on the part of each participant.

NetAdventure: One Model of Online Learning

We believe that the successful online learning activities will combine communication, community, compelling content, context, computation, challenging problems, and a personal commitment to active learning. While our university is experiencing great success in creating online communities and courses to support practicing classroom teachers, new models of electronic communication need to be developed to educate preservice teachers.

NetAdventure, developed by the Concord Consortium (http://www.concord.org/netadventure), is but one vital example of how the World Wide Web may be used to support a community of mathematical inquiry. While NetAdventure is targeted at secondary school students, it is rich enough to engage young children and adults alike. The design and content of NetAdventure offers a powerful model of what might be built for adults studying to become secondary mathematics teachers.

Designed around the metaphor of a summer math and science camp for Grades 7–12, NetAdventure requires participants to join a group of explorers. Each week, a theme such as collecting/interpreting data on the Web or building a model is used to unify a daily area of exploration. The user is presented the topic of the day along with the opportunity to explore a previous topic. A list of the other learners participating in the adventure appears along with the names of expert guides who lead each "expedition." Each daily topic offers background information, an opportunity to share data, hypotheses and questions with fellow investigators, and three problems of increasing complexity. The goals of community and communication are satisfied through the list of fellow participants, the public postings, and the reminders to share your thinking with your fellow adventurers.

The topic of prime numbers is explored in exciting ways. The background information is concise yet thorough, and hypertext links to sites dedicated to prime number research are provided. Participants learn about prime numbers and why mathematicians think they are an important area of inquiry. An invitation for learning is offered through a historical context, interdisciplinary connections to chemistry, and playful motivation. The simultaneous notions of prime numbers being both beautiful and fun may pique the interest of even reluctant learners. Here is the invitation:

> *The study of prime numbers has fascinated people for eons, pursued for its own sake and the beauty of its results ... Unlike chemists that have only a hundred or so elements to play with, mathematicians have endless numbers in which to search for primes. They even know that there are endless numbers of primes. With so many numbers to play with, finding primes should not be difficult. However, prime numbers are scattered among the whole numbers in a seemingly unpredictable manner. See whether you can see any pattern to them.*

The "Starter Problem" presents the concept of separating prime and composite numbers through the rather simple Sieve of Eratosthenes. Even the youngest learners can cross out every second number beginning with four, every third number beginning with six, and so forth. The result is a list of prime numbers. The "Super Problem"—Can you prove the great mathematician Euclid of Alexandria wrong?—requires much more active thought.

Many learners would be excited by the challenge to knock down one of the great pillars of mathematics. Could I possibly be clever enough to "defeat" Euclid?

Euclid, who lived around 300 B.C., thought he had a formula that would always generate primes. He suggested multiplying together all primes up to a certain value and then adding 1. He thought this would always give a prime. Can you prove him wrong?

MicroWorlds, the latest generation of Logo software, can be used to write a handful of procedures required to test Euclid's hypothesis (Appendix 1). In just moments, the program finds that the prime number 13 does not satisfy Euclid's rules for predicting prime numbers. How could it be so easy to disprove such a great mathematician? Could this be that multiplying all of the prime numbers up to 13 was too difficult in 300 B.C.? Which numerical system did they use at that time in Greece? Could such a difference have made the problem harder to solve? Could Euclid have saved himself embarrassment if he had a computer with the MicroWorlds software? NetAdventure provides the ability to discuss these questions within an online learning culture. An adventurer can not only post data and conclusions for public scrutiny but also the program used in the investigation.

The ability to not only share data, experiences, and opinions online but also share actual verifiable executable experiments creates a dramatic new paradigm shift in thinking about online learning. Much of what is offered as online teaching consists of delivering content to students. We are not only stressing the importance of two-way online conversation but also the desire to have learners share resources, data, tools, and experiments with one another. The shift from instructionist teaching online to constructionist learning is critical for the personal construction of mathematical understanding.

The NetAdventure "Mega Problem" posed about prime numbers deals with prime factorization of large numbers. A poignant connection to real life is made by discussing how large composite numbers with two large prime factors are being used for credit card encryption on the Internet. An Excel spreadsheet designed to help find prime factors is available for download. This context would undoubtedly make the seemingly boring act of prime factorization more relevant to a learner. At last, the familiar question "When will I ever use this?" can be answered.

Once again, MicroWorlds is used to solve the challenges posed in a matter of minutes (Appendix 2). Each NetAdventure topic concludes by inviting participants to post their own challenge related to the current area of exploration.

Within a handful of Web pages, NetAdventure creates a community of practice, challenges individuals to construct new mathematical knowledge, supports communication of mathematical ideas, and provides a powerful context for learning through compelling storytelling, history, and connections to real life. One powerful lesson for contemporary mathematics educators is that a learner can hardly keep pace with three problems per day if the problems are authentic and open ended. This stands in stark contrast to the dozens of more decontextualized problems students face each day in traditional mathematics classes. Another lesson is that the process skills associated with the ability to think mathematically and communicate mathematical ideas should take precedence over the memorization of algorithms. If you are not fascinated by prime numbers, tomorrow's topic may be bridge building. The Swarthmore Math Forum (http://forum.swarthmore.edu/) and Tapped-in (http://www.tappedin.org) offer a tremendous range of resources for teachers and learners alike.

Existing telecommunications technology makes it possible to develop environments, similar to NetAdventure, designed to meet the specific needs of preservice and inservice mathematics educators. Online telecourses are cost effective and create outstanding opportunities to learn in an ever-expanding community of practice. Our efforts to develop such online learning communities will reap tremendous benefits for our universities and children enrolled in mathematics classes.

Appendix 1
Procedures for Testing Euclid's Hypothesis

The startup procedure resets the list of prime numbers and starts counting up by 2. Each subsequent number is checked by the countup procedure to see if it is prime. If it is, the new prime number is added to the primelist and printed alongside the Euclidean hypothesis of multiplying all the previous primes and then adding 1. The word "true" appears if the new number is PRIME, false if it is COMPOSITE.

The Macintosh version of MicroWorlds crashes after the number 29 because the product is too large. You may be able to test higher numbers in the Win 95 version of MicroWorlds.

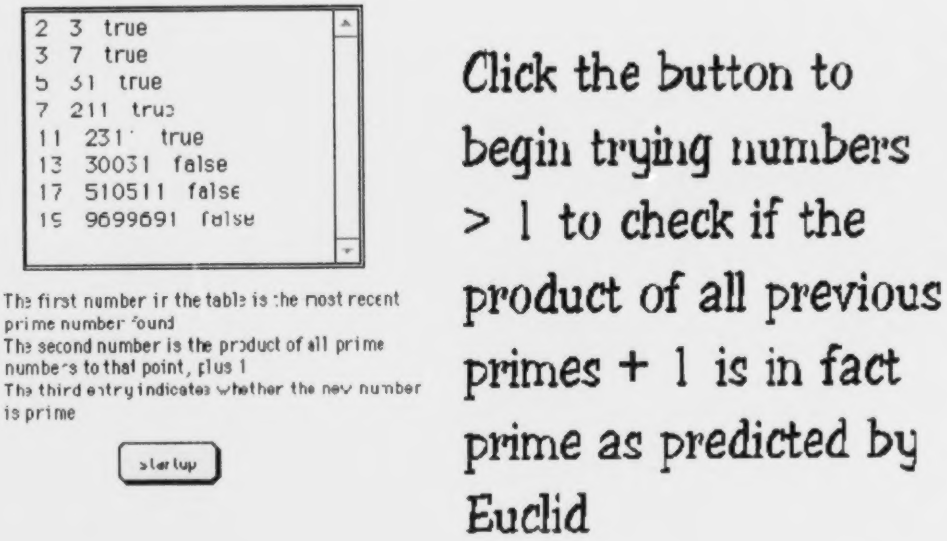
> The first number in the table is the most recent prime number found.
>
> The second number is the product of all prime numbers to that point, plus 1.

The third entry indicates whether the new number is prime.

```
to startup
ct
make "primelist []
countup 2
end

to countup :number
if prime? :number [make "primelist
lput :number :primelist print
(sentence :number (productall
:primelist) + 1 prime? (productall
:primelist) + 1))]
countup :number + 1
end

to prime? :number
output checkprimes :number int (sqrt
:number)
end
```

Remainder is a Logo reporter that reports the remainder of two numbers when divided. For example, remainder 10 3 returns the number 1. If remainder returns 0, then the numbers are divisible and therefore composite.

```
to checkprimes :number :factor
if :factor < 2 [output "true]
if 0 = remainder :number :factor
[output "false]
checkprimes :number :factor - 1
end

to productall :list
if empty? :list [output 1]
output (first :list) * productall bf
:list
end
```



```
2  3  true
3  7  true
5  31  true
7  211  true
11  2311  true
13  30031  false
17  510511  false
19  9699691  false
```

The first number in the table is the most recent prime number found
The second number is the product of all prime numbers to that point, plus 1
The third entry indicates whether the new number is prime

Click the button to begin trying numbers > 1 to check if the product of all previous primes + 1 is in fact prime as predicted by Euclid

Appendix 2

Procedures for finding the prime factors of any number.

```
to factor :number
make "factorlist []
ct
getfactors :number int :number
end

to getfactors :number :factor
if :factor < 1 [print :factorlist
stop]
if 0 = remainder :number :factor [make
"factorlist lput :factor :factorlist]
getfactors :number :factor - 1
end
```

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Workshop

Go Anywhere Multimedia: Digital Camera in the Classroom

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Key Words: digital camera, multimedia, publishing

Summary

Digital cameras are a powerful technology that can be incorporated in many multimedia applications. We will present a workshop that teaches the basic usage of the camera and then explore the many ways in which the digital camera can be used to enhance curriculum.

Topics covered will include:

Taking digital pictures

Displaying, protecting, and deleting digital images on the camera

Saving images to disk

Importing images into other applications

Word processing

PowerPoint

HyperStudio

Video

Presentation possibilities using the camera

Curricular uses of the digital camera

All participants will be able to take digital pictures, upload those pictures to a computer, and import the images into various applications. As a group, we will create a video presentation directly from the digital camera. We will explore possible curricular uses of the digital camera as a group. In small groups, participants will create presentations in various formats, which will be shared with the group.

Participants will leave this hands-on workshop with a firm grasp of the fundamentals of using a digital camera, as well as with concrete ideas for lessons utilizing the digital camera in a meaningful manner.

General Session: Technology Leadership

ISTE's SIGTE Paper Award: Integrating Technology Into Constructivist Classrooms - An Examination of One Model for Teacher Development

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Key Words: reform, professional development, constructivist classrooms

Reformers seek to change American schools so that students are more often engaged in complex, authentic tasks that demand higher level thinking and active learning. Technology can provide considerable support for that kind of education. However, integrating technology into a system of reformed practice is going to require more relevant and powerful programs of professional development for teachers—the agents who are being asked to drastically change what they teach and how. School districts must create new opportunities for their teachers to learn the technical and pedagogical skills to implement the reform agenda.

This paper session will present the results of a study that examined one such initiative, a teacher development program that aims to integrate technology into constructivist classrooms. The Shoreline Teacher Development Center established by the Washington Alliance for Better Schools, a consortium of school districts near Seattle, offers some structures and methods that can serve as models for districts seeking to design programs for their own faculty.

The paper/presentation will describe the TDC program, its objectives, selection processes, curriculum, and methods. In analyzing the effectiveness of the TDC, this study suggests that the following four elements are necessary for effective professional development and considers to what extent the Washington program contains them:

- challenges to frames of reference
- situated learning
- collaborative reflection
- long-term collegial interaction

The study also examines whether the factors common to exemplary computer-using teachers are present in the setting.

General Session: Emerging Technologies

If Only We Knew ... Anatomy of a Multimedia Project

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Key Words: AuthorWare, CBT, CD-ROM, multimedia, instructional design, interactive, project management

This session deals with the total project management of a CD-ROM produced for a graduate program in Public Health Administration at the Pennsylvania State University's Great Valley Graduate Center. The course, entitled "International Models for Health Care Organization," spans a seven-week semester, with classes meeting twice a week. The students study the health care systems in six democratic countries—Australia, Canada, France, Germany, Sweden, and the United Kingdom—and then compare them to the U.S. system, which was studied in a previous course. The course is composed largely of health care professionals with commitments to work and family. Travel and meetings can often interfere with class attendance. In addition, the large amount of material covered in seven weeks (classroom presentations, videotapes, outside readings) makes synthesis and analysis difficult.

The goal of this project was to produce a review tool that would enable the students to check their understanding of key points. They are able to access and progress through the material on either a country-by-country basis or across key points in each country. Video clips present corroborating or opposing views as well as interesting cultural perspectives. Demographic charts can be accessed at any time to show such information as the average length of hospital stays. Multiple-choice questions can be used either as a pretest to determine if a student needs to review a specific country or as a posttest. Help screens assist with navigation issues. Student feedback on the program was extremely positive.

This session discusses the difference between designing a program for initial instruction versus review, the importance of project planning and information management, and the integration of text, graphics, video, and audio elements. Attendees learn from the producers' right and wrong decisions. How important is audience analysis? What can you learn from beta testers? Which "rules" can you break? How many types of software do you need to know? This very practical session deals with the up-front issues that any novice producer needs to master to avoid frustration and disappointment.

The CD-ROM was produced as the final project by the team members in a graduate program in instructional technology at the Philadelphia College of Textiles and Science. Two members were completing the M.S. degree. The third member was completing a post-master's certificate in instructional design.

Poster Session
High-Capacity Digital Portfolio System

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Key Words: assessment, computerized portfolios, Christa McAuliffe fellowship

New innovations in education today include Howard Gardner's Multiple Intelligences, outcome-based assessment, portfolio assessment, and technology in education. All of these speak of child-centered learning where children, teachers, and parents are partners in the process of learning. The challenge for today's schools is to incorporate these into curriculum and instruction on a daily basis. The appropriate use of technology is the answer.

For many years businesses have used technology to improve production and management of their companies. Many homes today contain computers, modems, and fax machines. which have assisted in increased development of small businesses across America.

Although many schools today are equipped with the technological hardware, the use of these in the development and managing of classroom systems is limited or nonexistent. One such area for technological assistance is portfolio assessment.

Portfolios consist of individual students' class work that is collected over the course of the year. This collection serves as a representation of knowledge, learning style, and interests of the students who created them. Currently, a major drawback to the implementation of portfolio assessment is the storage of student materials over time. The folders, notebooks, and boxes that are often used are cumbersome. It is difficult to locate specific information quickly and easily. Many times the process of collection and reflection does not continue from one year to the next, as materials are easily destroyed or lost.

Current computer storage systems print material to floppy disks that do not provide multimedia or long-term storage capabilities. Found in many homes and schools, CD-ROM drives have widespread consumer acceptance. These systems can only be written on once; thus, they do not offer the option of revision or addition of information. iomega Zip drives provide the flexibility of floppy disks at nearly 100 times the storage capacity. The key to effective portfolios is to use multiple storage systems to take advantage of the strengths of each. Ideally, portfolios should be created on Zip drives with the final version at the end of the school year being written to CD-ROM.

Poster session participants will view examples of computerized portfolio systems designed by the presenter and her students as part of Christa McAuliffe Fellowship. The presenter will share time management and organizational strategies used across the curriculum. Teachers from all grade levels will learn how to use HyperStudio and other software programs in the development of multimedia portfolios for themselves and students. Poster and multimedia presentation, discussion, and handouts will be provided.

General Session: Technology Training/Staff Development

Integrating Technology Into Teacher Education Classes

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Key Words: ISTE Foundation Standards, teacher education, integration, technology, preservice teachers

Abstract

The Hope College Education Department is committed to preparing teachers to use technology as a tool to transform teaching and learning. A key issue in training is the integration of technology into the curriculum at all levels. Hope faculty have created a sequential and hierarchical mastery of technology-related skills. This process integrates a variety of technology tools into all existing education classes and eliminates the need for a separate computer class with no correlation to course content. The ISTE Foundation Standards serve as the guideline. The presentation will outline steps taken to ensure successful integration of technology and show the correlation of ISTE Foundation Standards to course work and student performance.

Background

Hope College is a four-year liberal arts undergraduate college, affiliated with the Reformed Church of America and located in Holland, Michigan. Hope offers a variety of courses in 53 majors. It is a residential college with approximately 2,700 students. Hope's Department of Education is currently accredited by the National Council for Accreditation of Teacher Education. Hope prepares students to teach in elementary and secondary schools, with approximately 25 percent of each graduating class receiving teacher certification.

In 1993, the Education Department created a technology mission and policy statement committing faculty to modeling technology applications in their courses and requiring students to learn and apply these tools in a variety of educational settings. The framework used to guide the integration of technology tools was the ISTE Foundation Standards. These standards are reflected at all levels of the teacher preparation program.

Level I—Choosing Teaching

Courses at this level focus on an introduction to research skills using electronic resources, basic word-processing skills, on-going dialogue between students and faculty using electronic mail, introduction to digital cameras, and resources for facilitating life-long learning and emerging roles of the learner and the educator.

Level II—Learning How to Teach

Courses at this level focus on multimedia production, using computers to support problem solving, and designing and delivering instructional units that integrate a variety of software and learning tools.

Level III—Applying Teaching

Courses at this level focus on delivering and assessing student learning activities that integrate computers/technology in the classroom and the discussion of ethical and legal use of technology by students and educators.

The presentation will share the following:

- Ways to encourage faculty to integrate technology into their classes
- Ways in which professors have modeled technology
- Examples of student work for each of the three levels of teacher preparation
- Student work at elementary and secondary levels
- A framework to design a comparable program

Paper Session

Give Girls Some Space: Gender Equity in Collaborative Technology Activities

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Key Words: gender and technology, computers and collaborative learning, girls and software design

Abstract

Equitable computer collaborations in mixed-gender teams have been a pressing issue for many years. While some have argued for creating single-gender teams or girls-only computer activities, the current study examines a three-month, software design activity in which mixed teams of girls and boys (10–12 years old) designed and implemented multimedia astronomy resources for younger students. In this context, we assessed not only the students' science and programming learning but also how the status of girls was defined by the students themselves at the project outset and how it changed throughout the project duration. We found that the documented positive change in girls' status was impacted by social and physical work arrangements but also resulted in less flexible planning conceptions. We discuss the implications of these results in regard to issues surrounding the development and maintenance of gender equity in computer use.

As recent research has shown, the road toward becoming technologically literate and scientifically competent has been a "leaking pipeline" for girls and women in particular, from the elementary schools where girls feel disenfranchised in science and technology to universities where fewer female students choose science and engineering majors (Camp, 1997). A variety of explanations has been offered for this trend, ranging from different attitudes toward computers (Shashaani, 1994) and different levels of participation in computer and science courses (Chen, 1985; Linn, 1985) to cultural and social conditions found in the respective domains (Sadker & Sadker, 1994) and different representations of women in media publications (Heller, Brade, & Branz, 1994). While each of these variables alone or in combination has an impact on situating girls' interactions with computers, we examined more closely girls' access to computer resources in classroom activities. With the increasing use of computers in classrooms, there remains the issue of whether all students participate equally and receive equal benefits. We were particularly interested in identifying the kind of activities and support structures that can be used in helping girls break down barriers to technological access and gain expertise in a variety of mixed-gender settings.

Toward that end, we investigated students' activities and collaborations during a three-month computer project. In this project mixed-gender teams of fifth and sixth graders used Logo MicroWorlds in their classroom to design multimedia encyclopedias about their astronomy unit for use by younger children. We paid particular attention to the status of girls in these mixed-gender teams—their status positions at the outset (as defined by their levels of access to programming and other technologies in use), the change most girls experienced in going from low-status to high-status designers, and the means by which these changes were accomplished. In examining this last factor, we outline several support structures that emerged over the course of two projects to address girls' needs. Finally, we conclude this paper with a discussion of the implications of our findings for developing and maintaining gender equity in educational technology use.

Theoretical Background

Many girls are not receiving the same kinds of opportunities to become technologically skilled as boys are (e.g., Wellesley College Center for Research on Women, 1994). Boys develop alliances with computers largely due to their extensive out-of-school computer experiences. Boys are more likely to attend summer computer camps than girls, more boys than girls have their own computers at home, boys play more video and computer games than girls do, and boys are more likely than girls to see themselves depicted (as male main characters) in these games (Sadker & Sadker, 1994). These factors relating to amount of experience with computers have a significant effect on students' attitudes and perceptions. In a survey of high school students, boys had higher ratings than girls on all of the following: perceived competence with computers, positive attitudes toward computers, and perceived utility value of computers (Shashaani, 1994).

Gender differences also arise when boys and girls use computers in the school context, even though so-called "equal opportunities" may be presented. Studies of computer use at school have found that when computers are used during class time, boys are more aggressive at grabbing computer space, often refusing to share with girls (Sadker & Sadker, 1984). In observations of student dyads working on the same computer, boys were shown to use more aggressive tactics to gain control, such as grabbing the mouse and pulling it away from their partner. Girls, on the other hand, used more "noncontact" methods, such as verbal requests. Notably, when mixed-gender dyads were observed, the girls' requests were often ignored

(Inkpen, Booth, & Klawe, 1991). Boys also are more likely to initiate and maintain control of school computers during nonclassroom hours, such as lunch time and before or after school (Canada & Brusca, 1991).

These research findings can prove disheartening to those interested in providing equitable and empowering technology experiences for children of *both* genders. Studies have shown, however, that when girls have as much exposure or interactions with computers as boys do, gender differences tend to disappear (Linn, 1985). In learning situations in which children can work on computers at their own pace and engage with tasks according to their interests and styles, girls tend to be as proficient as boys in programming (Harel, 1991; Kafai, 1995). Giving opportunities for access thus seems to be a crucial aspect in overcoming the widespread gender differences as well as finding computational activities that appeal to both genders (Spertus, 1991). Access, however, is often hard to come by—both in activities with computers and those without.

Even when computers are not involved, putting students in mixed-gender teams for collaborative work in academic subjects can result in very different experiences for boys and girls. Research shows that gender is often a strong predictor of status in heterogeneous groups; thus, girls' contributions to group work end up being less valued than boys' (Cohen, 1994). When dissension occurs in mixed-gender groups, boys' opinions are also more likely to win out over girls'. These gendered interaction patterns sometimes have consequences for girls' ability to make the most out of collaborative work, as evidenced by subsequent knowledge assessments (Webb, 1984). Even when academic achievement is not affected by these differences in interaction, girls' self-esteem and interest in the subjects in question may suffer (Wilkinson, Lindow, & Chiang, 1985).

In attempting to ensure that girls will have the technological opportunities they need, some researchers and practitioners have taken the approach of providing "female only" environments. Whether this means pro-active technology intervention programs that are exclusively for girls (Martin & Heller, 1994) or forming single-gender collaborative groups in after-school computer clubs (Wood, 1996), the assumption in most cases is that girls will have a more positive experience in the absence of male computer users. While these programs represent important steps in introducing girls to technological activities, we find that eventually girls will have to learn how to negotiate access in mixed-gender settings. Our aim in this project was to find out how girls (and boys) might react to the challenge of working with programming technology in mixed-gender groups in a classroom setting. Based on the existing research, we anticipated that at the outset of the project girls would occupy lower status positions in their groups; however, we hoped that through careful attention to addressing their needs in the project, girls' status would change. Our primary goal, then, was to investigate how we as researchers and project directors could help girls rise to the challenge and succeed.

Research Participants, Context, and Methods

The software project from which our gender study comes is based on the model of "learning through design," in which students simultaneously learn new information and design a relevant product reflecting their knowledge (Harel, 1991; Harel & Papert, 1990; Kafai, 1995). The project took place in an urban elementary school that functions as the laboratory school site for UCLA. The participating classroom was equipped with seven computers; one of each was set up as a workstation for the seven table clusters. An additional seven computers were in an adjacent room and were mostly used for related Internet searches.

An integrated class of 26 fifth- and sixth-grade students participated in this project. There were 10 girls and 16 boys of mixed ethnic background (19 Caucasian, 2 Hispanic, 3 African-American, 2 Asian) ranging between 10 and 12 years of age. With the exception of 10 students—8 had participated in another design project the previous year and 2 knew programming from home—none of the other students had any programming experience before the start of the project. All the students had used computers in school and were familiar with word-processing packages, graphics software, *Grolier's Multimedia Encyclopedia*, and searches on the World Wide Web.

Heterogeneous groups of three to four students each were arranged in seven teams according to the following criteria: one "experienced" designer (who had participated in the previous design project), mixed gender, and different academic skill levels. One week before the start of the project, students were given an introduction to the main features of the MicroWorlds Logo programming environment. The assignment was to build an interactive multimedia resource about astronomy for younger students. Over the course of several months students created their own research questions about astronomy, researched these questions using various sources, and represented their findings in a group software product. Students worked three to four hours per week on the project for a period of three months, spending 46 hours in total, of which 23 hours were dedicated to programming. Science instruction and programming time were combined. Groups were videotaped regularly and their activities were documented via fieldnotes on a daily basis. Criteria for determining boys' and girls' status roles in collaborative teams were developed through ethnographic observations.

Defining Status

In most previous studies of collaboration, groups of students are engaged in a single task, such as solving a math problem or writing a story. In the learning-through-design environment, however, the final task of making a multimedia encyclopedia requires many different kinds of activities in order to be accomplished: research, drawing or planning screens on paper, graphic art, and programming. Observations led to the conclusion that students' own conceptions of status in this more complex environment were based on what activities were most desirable and who had the most opportunity to do them (see Table 1).

Table 1. Activity status

High-Status Activities	Medium-Status Activities	Low-Status Activities
MicroWorlds work	Grolier's research	Book Corner research
Internet research	Asimov CDs research	Drawing screens on paper
Leading software demo	Word processing	Team progress reports
Consulting	Sidelining	Doing nothing

In actuality, students managed to divide labor in their groups into many more individual tasks than the four mentioned above: research, planning screens, graphic art, and programming (see Table 1). In fact, students collapsed the tasks of programming and graphic art into one category, known as "MicroWorlds," such that anything done in that environment was considered high status. A related activity also having high status was that of "consulting," meaning that once a student (often male) had developed expertise in a certain area of programming, his or her help was often solicited by other groups. This "expert" usually also led the discussion of his or her group's software at the first several demo sessions, in which groups shared their developing products with one another. Students divided the activity of content research into multiple categories, with research on the Internet being the most prestigious, followed by research using available computer software (*Grolier's Multimedia Encyclopedia*) and CD-ROMs (*Isaac Asimov's Universe series*), and book research having the least desirability.

The remainder of the ways in which labor was divided in the design project carried lower status in students' design teams. Only two of the other activities, both of which had medium status, afforded any access to the computer at all. Word processing developed as a task that would be performed by someone who had accumulated information about astronomy from research but was denied access to the programming environment. These students would type up summaries of what they had found out about particular topics in a word-processing file, which could then be imported into MicroWorlds by another team member who was programming screens for the multimedia encyclopedia. "Sidelining" was defined as sitting next to another team member who was programming. The "sideliner" watched and occasionally provided design suggestions or help with debugging but rarely touched the keyboard or the mouse. The remaining low-status activities afforded no computer access and were considered relatively dull by almost all the students in the class, both those who avoided doing them and those who did them by default.

For data analysis, students received status codes based on whether or not they typically engaged in high-, medium-, or low-status activities. Students received a 3 for high status, a 2 for medium status, and a 1 for low status. Fieldnotes and videotapes of group interaction were coded for each student's status level, and students received a single status score for two time segments during the project. The first time point (T1) was after the first three weeks of the project, and second time point (T2) was approximately two weeks before the end of the project. We then conducted analyses to determine what factors predicted status at T1, predictive factors at T2, and change in status levels over time.

Results

Learning assessments. In terms of the effectiveness of the overall intervention, we found that the design project was successful as a vehicle for both science learning and Logo programming development. All students were administered pretests and posttests in astronomy and Logo. Our preliminary analysis showed significant differences for the pretests and posttests in students' understanding of Logo ($p < 0.05$) and astronomy ($p < 0.05$). No gender differences were found in student pre/post gain scores in either astronomy or Logo. While we have not included a comparative component in our research, we know from prior studies that included comparative assessments to students that learned programming by other pedagogical means (Harel, 1991, Kafai, 1995) that software design was a more effective way of learning subject matter and Logo programming.

Gender and Status. The factors of age, gender, previous design/programming experience, and academic achievement were analyzed via multiple regression for their predictive value for status at T1. A composite of two factors was significant, that of classroom leadership and gender ($p < .001$). These two variables were confounded, however, because all but two of the nine students nominated as classroom leaders by their teacher were male. Statistical results confirmed what we had observed during student work time: a significant number of girls were engaged in low-status activities that afforded little access to new technologies.

Students' status levels did not stay the same throughout the project. At T2, status was measured again and found to be not significantly correlated with status at T1 (Pearson correlation = .1880, $p > .100$). Furthermore, the composite of leadership and gender was not significant as a predictor of status at T2 ($p > .05$). Girls' status, in particular, changed greatly from T1 to T2 (see Figure 1). While at the beginning of the project all but three girls had low-status group roles affording very little computer access, at T2 the majority of girls were engaged in high-status activities. Girls were seen taking more leadership roles in demo sessions and programming on the computer more frequently. It appears that the software design project provided girls an opportunity to change the pattern typical of girls in mixed-gender teams—remaining low status throughout the duration of group projects.

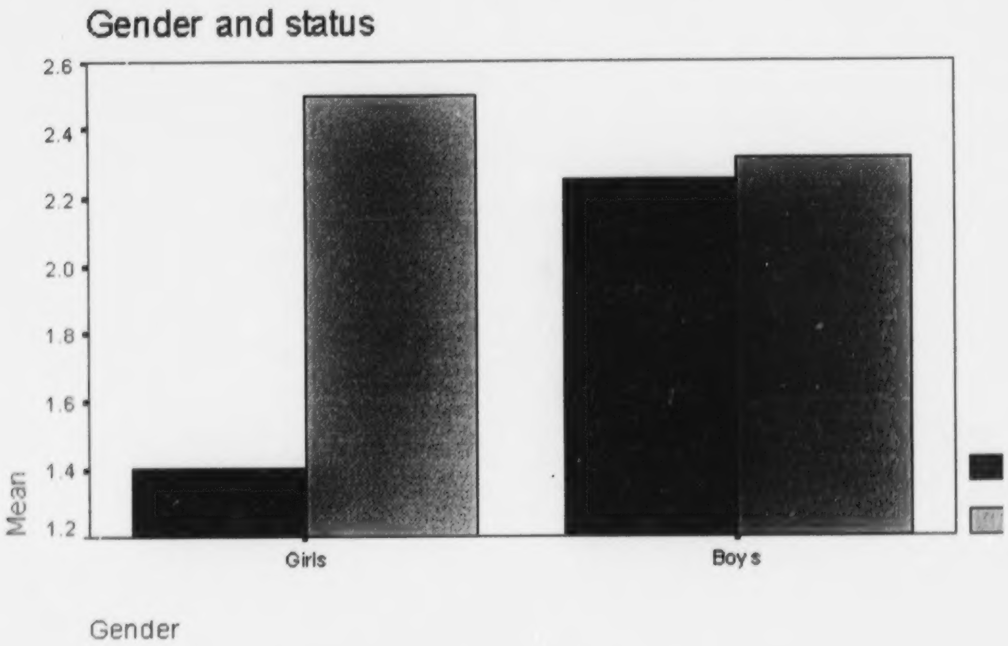

Figure 1. Gender and status.

Analysis: Give Girls Some Space

So how did these status changes for girls take place? We observed that status changes began gradually occurring as features were added to the project to address girls' emergent needs. We refer to the process of changing the classroom design studio to reflect diverse needs as "creating spaces" on the social and physical planes of the environment. Within these "spaces," girls (and some boys as well) found contexts that were more compatible with their own ways of interacting, working, and thinking than they had encountered in the initial structure of the design environment. In this next section, we describe the "spaces" that were created, and we discuss how they emerged and their subsequent effects on girls' attitudes and behavior in the design project.

Social Space

Research shows that when mixed-gender groups of students engage in collaborative work with advanced technology, students' effort and interest in different aspects of the project tend to fall out along gender lines. Fredricks, Blumenfeld, and Bass (1997) found that while boys in mixed-gender groups invested more energy in mastering technology, girls were more concerned with orchestrating and organizing their groups. In our project, we found this to be initially the case as well; implications of these gender differences for group communication and conflict resolution became evident as the project progressed.

Early in the design project, the task of organizing and reporting on group progress toward product completion was assumed by girls. This task required talking to everyone in the group about what activities they were engaged in and what their goals and plans were. Girls experienced frustration with this activity, due to the fact that many boys did not want to sit down and discuss anything if it took time away from programming. Girls were also concerned with resolving interpersonal problems within teams right away when they arose, whereas boys focused more on getting computer work finished and would keep right on working and ignore problems that came up, even to the extent of not listening to girls when they attempted to talk about these issues. After observing these interactions for several weeks, we saw a need for a specific "space" on the social plane of the design project that could be an appropriate time and place to air personal conflicts and frustrations in a safe and mediated environment.

Our solution was to create group meetings that were mediated by either the classroom teacher or a researcher. These meetings occurred about once every 10 days. Students were told that each person in the group would have a chance to say what was bothering them and then the whole group would address each issue. We found that while we had initially instituted the sessions to ensure that girls would be listened to by boys in airing their complaints, boys also had many issues they needed to work out, but which they hadn't been addressing during computer work time. (Issues the boys were upset about concerned Internet use for legitimate research versus "surfing" for fun, ownership and piracy of ideas, and accusations of "goofing off.") All groups came to some resolutions through these discussions, and most boys and girls subsequently reported that there were fewer conflicts in their groups as a result of the meetings. Thus, although the "social space" of group meeting time was initially created as a place to address girls' concerns, boys benefited from this development as well.

Physical Space

Canada and Brusca (1991) argue that girls' initial lack of enthusiasm in computer-based environments may be partially attributable to the physical structure of the computing facilities themselves. Since the majority of computer environments take the form of individually segregated workstations, this arrangement tends not to appeal to girls and their preferences for a work style characterized by more social networking. In our design the group workstations were spread throughout the classroom, making it difficult for students in different teams to communicate with one another without leaving their seats. At the beginning of the project the computers in the adjacent lab were designated for Internet searches and other research only; students were supposed to program in MicroWorlds at their groups' workstations inside the classroom. We found that when girls had opportunities to work at the classroom computer workstations, they often got much less accomplished than boys did in the same amount of time due to frequently showing off their new work to friends and getting up to view one another's screens. (In fact, one of the boys' chief complaints during the group meetings was that girls did not make "good" use of their computer time when they had it.) Thus, the arrangement of physical space in the classroom seemed to be holding girls back—until they changed it.

During the fifth week of the project, a few girls began "breaking the rules" and appropriating the laboratory computers for MicroWorlds work. The physical arrangement of the lab was such that computers were lined up in rows right next to each other along the walls, rather than being spread out. These girls regularly moved files back and forth from lab computers to group workstations via file sharing or floppy disks. Upon seeing how well this arrangement worked for those girls, coupled with the fact that most students had finished the research phase of their work, we opened up the lab for regular MicroWorlds use. Changes took place almost immediately. Rather than waiting to be told what to do by boys and whether or not they would be *allowed* to work in MicroWorlds for the day, many girls often grabbed their floppy disks and headed off to the lab with a long list of things they wanted to accomplish on their own.

Creating a new "space" on the physical plane of the design environment in which to do programming allowed individuals to work and help one another in the way they felt most comfortable. Most boys worked at their own individual stations, which were spread out across the classroom, and would call one another over for help with specific things. Many girls (and a few boys), on the other hand, preferred to work collaboratively and used the space in the adjacent computer lab so that they could talk and give programming/design advice by glancing over at one another's screens while they were all working together. This arrangement seemed to encourage those involved to stay on-task longer and develop innovative ideas so that they could be shared with the rest of the community. These findings are consistent with existing research that shows that motivation and achievement are higher among girls in peer groups with similar mindsets and academically oriented goals (Fredricks & Alfeld-Lo, 1997). As documented by students' log files, the amount of programming being done by girls went up after the changes in the "physical space" of the design environment took place. It should be noted that not *all* boys or *all* girls used the lab computers or workstations in gender-specific ways. The point is rather that the addition of another "space" in which to program allowed students of either gender to find a workplace that was compatible with their own preferences.

"Paying the Price"

While in the previous sections we reported on the positive impact of creating spaces that allowed girls to work more productively, here we identify an issue that raised some concern. There is evidence that support structures implemented within the science design project facilitated girls' transformation from low- to high-status activities; however, we see a potential for girls to pay a price in their struggle for greater computer access. These results were based on case-study data from seven students (three girls and four boys) who participated in the science design project twice over a two-year period. In the first year, these students worked on their projects independently. During the second year of the project, which provided the data for this study of gender differences in negotiating computer access, these students faced a new challenge of planning and managing a team project. Both prior to and at the conclusion of the second project, the students were asked in questionnaires and interviews to explain what is "planning" with respect to projects. Responses were classified in one of two categories: (1) top-down beliefs and strategies suited to well-defined problems (examples include doing things ahead of time, such as setting goals, deciding what to do, and deciding an order for doing things); and (2) bottom-up beliefs and strategies that lend themselves to ill-defined design problems (examples include doing things in a more iterative manner, such as brainstorming different ideas for what the artifact should be, reviewing and/or changing one's plans in response to new information, and recognizing the need to get more information about a topic while working on a project). Responses from three of the four boys demonstrated that while they had not abandoned beliefs about the usefulness of top-down strategies, their planning repertoire included an increased percentage of bottom-up strategies at the end of the science design project. This was not the case for the girls, who at the end of the project had not expanded their planning repertoire to include more bottom-up strategies. While the girls' focus on conflict resolution led to increased status and computer access, it appears that boys benefited from greater initial computer access and from their focus on project work rather than on solving collaborative problems; they developed a more flexible view than the girls of what it takes to plan and manage a project.

Discussion

In our analysis of results, we paid close attention to the various factors that helped girls change their status. In the following discussion we want to address several key issues in designing and implementing computer-based learning environments, consideration of which can help support girls and boys equally in their learning endeavors.

Timing of Interventions

One issue that needs to be addressed concerns the place and timing of interventions. Previous intervention models, such as science and technology after-school programs and summer camps, try to reach out to female student populations in high schools and colleges. These are important programs, but we hold that the timing of such interventions is too late, considering that girls form many beliefs about themselves and subject domains during the elementary school years. For that reason we propose to situate interventions much earlier in development, thus providing younger girls with opportunities to interact with advanced technologies and science in substantial ways.

Girls as Software Producers

A related issue is the emphasis we place on children as producers, rather than strictly consumers, of computer software (Kafai, 1995). Our findings suggest that while the software industry currently strives to create products for girls as software consumers, the idea of girls as software designers may be still hard to swallow for 10–12 year olds. In the analysis of factors predicting access to the full practice of software design at T1, we found that gender was the only significant predictor. This finding is of particular interest because past research on participation patterns in groups engaged with more traditional school tasks has concluded that while gender is often one important factor in collaborative interactions, academic skills, popularity, and ethnicity usually also play strong roles in affecting interaction and access (see review by Cohen, 1994). We found that in the activity of collaborative software design, however, gender was the most salient characteristic. These results are somewhat disturbing. They suggest that even at a young age, children's actions with respect to classroom technology are very gender biased—another argument for the early positioning of interventions mentioned above. The change in access most girls experienced, however, shows that these behavior patterns are not immutable in a supportive environment.

Final Thoughts: New Era, New Questions

Education is currently in the throes of a trend in project-based learning (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991) for computer use to be integrated into long-term, multifaceted projects such as the one documented here. Computers no longer reside solely in a distant laboratory, with few if any ties to other classroom activities (Kafai, 1995). These new developments have staggering implications for the way we think about gender and computer use. If girls have little access to computer resources in these integrated classroom settings, they not only miss out on the opportunity to develop technological literacy, but they also risk missing out on learning other subject matters being mediated by computer use as well.

Even when it appears that girls are spending an equal amount time in front of the computer, advocates of gender equity still should not be entirely at ease. In our project, which was supposed to provide students with creative and innovative opportunities, girls' initial computer work consisted mostly of word processing and consumer-based use of software encyclopedias. These results are cause for concern. We are reaching a point in gender and technology research where the issue may no longer be about if girls are using the computer but rather *how* are they using it. Results from our study confirm this, in that there was an initial division of labor where boys dominated all of the available "cutting-edge" technology, such as the Internet and the programming software. Through creating new spaces in the environment to address girls' needs, we found ways to alleviate this situation and provide opportunities for girls to gain access. We would also argue that such measures are not only helpful but necessary to ensure the continuation of progress toward gender equity in technology environments.

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Paper Session

Using Technology to Enhance Literacy in Elementary School Children

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Abstract

This naturalistic study of elementary school children using computers and telecommunications highlights (a) the journeys of several third graders from nonreaders to researchers and (b) the electronic interactions of two fourth graders. Observations, interviews, and review of documents helped the researcher gain insights into how technology and the Internet can become highways to enhanced literacy.

I had a good time yesterday.
I enjoy learning about computers.
I like sending email.
I don't have a computer at home. I wish I did.
Katey, Age 10, September 27, 1994

The electronic information age is here, and adults as well as children are using an incredible number of new ways to gather and generate information. Even the metaphors used to describe the use of this new technology give evidence to the wide range of possibilities. Electronics users are writing in hypertext; exploring cyberspace; living in virtual communities; scooping interactively with CD-ROMs (Compact Disc Read Only Memory) and laserdiscs; using FTPs (File Transfer Protocols) to upload and download information from around the world; communicating asynchronously using e-mail with colleagues, friends, like-minded strangers, even the President of the United States; and cruising or surfing the Internet, commonly referred to as the information superhighway. This paper is the story of elementary school children using technology to explore cyberspace and to communicate with others via e-mail. Although not the primary goal, enhanced literacy is an important outgrowth.

Theoretical Stance

*I love your class.**
I haft to write to some one else. BY
Amie, Age 9, June 10, 1994

> *Dear Marcia (mom ,)*
> *what are we having for super?*
> *Dady seid he miht tack me to the law librarey*
> *after computer clas,*
> *I love you From Charles*
> *Charles, Age 7, November 14, 1994*

* Throughout this study, I quote children extensively. In these quotes I use their spellings, not conventional spellings, so that the reader can get a better sense of the voices of the children.

This study tells a story, and every story has a storyteller. I am the storyteller and this story reflects my beliefs, biases, and world view. Meredith Cherland (1994) eloquently frames her book *Private Practices* in this way, and I use her words as a frame for my story as well:

> *I am the person who has chosen the events that comprise the story.*
> *I have arranged them and shadowed them with my meanings ...*
> *In this way, I have done what every researcher and storyteller does.*

This is not an objective story; no story is. For that reason, I explicate my beliefs and theoretical stance below.

> *I have seen people and events in the light of my own belief systems, experiences, and discourses, and I have told what I hope is a compelling and authentic story that is consistent with what I believe about the world. (p. 2)*

Theoretically, I view both literacy and the computer as social and cultural constructions. Both of these constructs are assumed to be constructed within a culture and are defined in numerous ways by different cultures and individuals within any given culture. I assume, as does Gilligan (1982), that the way people talk and write about their lives is significant, that the language they use and the connections they make reveal the world as they see it. Therefore, I used interpretive methods in an open-ended environment so that I might better study and understand the interface between literacy and technology.

Meaning is endowed by individuals within a particular context—in this case, the classroom culture of a Telecommunications Workshop offered by the researcher to elementary school students. The meanings the children attached to the construct of "computer" were as individualized as the children themselves:

> *A computer is a machine with a screen. You can see great pictures on it.*
> *Rob, Age 9*
>
> *A computer is a machine you can write letters to your friends on.*
> *Mandy, Age 11*

A computer lets you get around to place you want to go.
Liza, Age 9
A computer is to help people look up things.
Tom, Age 10
A computer is for playing games, doing research.
Andy, Age 9

Review of Relevant Research

As a feminist researcher, I based my classroom organization and vision on feminist pedagogy. Liz Stanley and Sue Wise (1993) believe that "the key role of the feminist researcher [is] *producing*, not just reflecting, the social reality such research is apparently designed to 'uncover.' [The] researcher is an active presence, an agent, in research" (p. 6). In short, I helped create the interactions I wished to study. I see a classroom based on feminist pedagogy as a community of learners where power is shared and where participatory, democratic processes help learners develop independence. This classroom is collaborative, cooperative, and interactive. It is an active classroom where risk-taking is encouraged, where intellectual excitement abounds, and where power is viewed as energy, capacity, and potential rather than domination.

Selfe (1990) maintains that it's time for educators to re-examine the "theoretical and pedagogical premises upon which they base their classes, their research, and their curricula" (p. 190). Now that the first wave of excitement about the new technology has subsided, Selfe asserts that educators must conduct research that will help teachers move away from the "atheoretical, untested, [and] unexamined" (p. 190) approaches currently in use, such as (a) computer labs where all students work in a lock-step, computer literacy curriculum, (b) the use of computers as a reward for students who have completed work or behaved well, or (c) the use of computers as electronic workbooks that offer children endless drill-and-practice exercises to reinforce isolated skills. Selfe suggests that teachers must be more theoretically informed as they integrate computers into the elementary school curriculum.

Gail Hawisher and Charles Moran's (1993) essay "Electronic Mail and the Writing Instructor," explored the possibility of an e-mail pedagogy. They suggested that e-mail is beginning to dissolve some of the long-standing boundaries between students and teachers. They envision this new pedagogy as a vehicle for questioning how we teach, how e-mail may change how we teach, how it may personally impact our lives or impact our roles as teachers and as scholars, or whether e-mail is even a medium worthy of study. This pedagogy will allow us to investigate differences between paper mail and e-mail and to examine the social and cultural ramifications of using e-mail as a medium for connecting with others.

Description of the Study

Searching the Internet really taught us about
what is happening around the world and why it's
happening.
Everyone learned ALOT, even Alice!
Laurie, Age 9, December Newsletter

In the role of teacher/researcher, I offered three intensive Telecommunications Workshops to elementary school students. Approximately 12 students attended each workshop. The average age of the children was nine years, one month. The 30 children who self-selected the workshops spent between 35 and 105 hours interfacing with technology outside the regular school setting. 59% of the participants were girls, 41% were boys. There was racial diversity within the group: 69% White, 17% Hispanic, 7% African-American, and 7% Asian. The workshops took place in a computer lab that housed 12 high-end Macintosh computers with color monitors and internal CD-ROM drives. They were able to support multi-use telecommunications via Ethernet connections; all were networked to an Apple LaserWriter printer. The site also housed a teacher work station containing a high-end Macintosh, an overhead projector, and an LCD projection panel. This setup allowed an image on my monitor to be projected onto a large screen so that participants could easily view the image and the process I used to achieve this image.

After I introduced the children to both electronic mail and several tools for browsing the Internet (Gopher, Veronica, and Mosaic—Netscape was not available at the time of this study), the children were responsible for deciding how to spend their time each day. My goal was to provide an open-ended environment that would help me understand how the children used and viewed technology and how reading and writing might be enhanced through the use of technology. Such a format did not impose a specified "curriculum" with its corollary skills and outcomes, but rather it allowed the children to make choices about how they wanted to spend their time, which topics they wished to pursue, and who they chose to write to via electronic mail.

Setting the Stage

When I first started doing my research with the Internet,
I thought it was going to be very hard.
But after a bit, it really wasn't so hard after all.
Julia, Age 8, December Newsletter
I speld my water and I got all my spelling rong.
I had a hard day and a very rauf day and a mean day today
did you have a mean day? I like you as a teacher.
love Jing-Mei
Jing-Mei, Age 8, September 26, 1994

Two weeks have passed since the first day of our Telecommunications Workshop. I think back to that first day remembering the wide-eyed wonder of the 9- and 10-year-old children as we began our adventure together. For now, the computer lab is quiet. I am here alone waiting for the rush of excitement that always occurs when the children arrive. I have completed my morning tasks: setting up the camcorders and audiocassette recorders, checking the electronic equipment, reading and answering my extensive e-mail, then settling and focusing myself for three and a half hours of intensive learning and interacting with 12 energetic and inquisitive children. I hear the pounding footsteps in the hall; five boys and seven girls dash to get to our Telecommunications Workshop. Even though there is a computer for each child, they rush to take the one they have grown fond of. Girls prefer the front of the room, boys the back. The routines the students and I have negotiated are working smoothly. Without instruction or direction from me, the children turn on their computers, open their electronic mail programs, and anxiously begin reading and answering their mail. The room is practically silent; an occasional laugh or exclamation permeates the silence. All eyes are on computer screens; all little fingers are poised over keyboards. E-mail is important. During the three workshops, the participants generated more than 1,300 e-mail messages!

Profile One

> *Thnks for send mall.*
>
> *Tony, Age 10, June 14, 1994*

Tony is the first to finish reading and responding to his e-mail, completing what he wishes to do in about five minutes. He moves hurriedly to Veronica (an Internet searching tool). When I ask him about his e-mail correspondence, Tony replies that he's written all he intends to and that he wants to get immediately into Veronica to look for pictures of aliens. Later I discover that Tony has written his standard "I hope you have a good day" message to the class and his typical "Thanks for being my teacher" or "Thanks for sending mail" message to me. Tony does not enjoy writing to me or his classmates; he struggles with both spelling and the keyboard and would much rather spend his time searching the Internet for images of his own choosing.

Toward the end of the workshop that day, Tony rushes up to me excitedly. "Look at all my alien pictures," he exclaims, leafing through a dozen different images he has found, downloaded, and printed that day.

"I did these all by myself," he reports triumphantly. "Can I find more tomorrow?"

Tomorrow follows tomorrow and soon he has accumulated quite a collection of pictures of aliens. Some resemble bizarre humans and others are ghoulish and often sinister creatures.

"Why don't you write a short report about aliens?" I inquire. Several days later, Tony presents me with the following piece:

> *ALIENS*
> *by Tony Cortez*
> *An alien is frm outr*
> *space . It is big, and*
> *ugle . And it bleeds*
> *acid and it kills.*
> *And they live dep*
> *in space. They like*
> *to bee alone. The*
> *queene staz with the*
> *eggs. The queen has*
> *2 parts. The queen*
> *makes the babys*
> *on a prsin.*

> *The End*

Tony sees no need to write to people whom he sees and talks with every day. Oral communication is less time consuming, more direct, and less frustrating than written communication. Speaking also eliminates the possibility of embarrassment caused by what Tony calls his "bad" spelling. Writing via e-mail is neither rewarding nor useful for Tony, and he does not apologize for pursuing his own agenda. He complies in a minimalist way with my request to write e-mail, then moves hurriedly to explore the Internet. After locating numerous pictures of aliens, he begins gathering textual information about aliens. By seeking his own path, he both engages in authentic reading and writing and enhances his confidence and competence in reading and writing. During our final interview, Tony reported:

> *I didn't know hardly anything about computers when I started. Now I know how to print. I know how to do Veronica. I know how to do asumail. I know how to print pictures. I know how to do Internet, Gopher, and TurboGopher. I know how to go to other states and talk to them. I KNOW LOTS! And I know how to READ and WRITE MUCH, MUCH better!*

Profile Two

> *This message is from my house*
> *on my motem.see you in class.*
> *Christi, Age 10, June 22, 1994*

Christi and Mandy spend considerably more time on their e-mail correspondence than does Tony. Best of friends, they choose to sit next to one another during our workshop. Mandy missed the first few days of the workshop and Christi has voluntarily assumed the role of peer tutor. They often chat quietly as they read and write messages and frequently write e-mail messages to one another. Today, they exchange five messages within a nine-minute time span:

Mandy	9:34:48	Dear c, I can't what tell you come over.
Christi	9:37:51	Dear Mandy, My Sister ate all the apples lastnight so I didn't have anything to bring!
Mandy	9:40:57	How rude !!!!!!!!!!!!!!!!!!
Christi	9:42:59	Dear Mandy, Are you talking about my sister?
Mandy	9:43:59	YES !!!!!!!!!!!!!!!!!!

Christi also writes to three of her female classmates—Katey, Julia, and Janet:

To Katie	9:12:40	Dear Katey, Will you call your mom and ask her if you can come over?
To Julia	9:37:51	Dear Janet, I am having a good day!
To Janet	9:25:09	Dear Jenni, How are you? If you see Sterling tell him I said hi O.K!

Mandy spends her time writing her Dad, who has an electronic mail account.

Dad	14:16:00	Thank you for the note. It is one of the brightest parts of my day when I see your ID on my "E-Mail". I love you too and thanks again.
Mandy	9:08:04	Dear dad, Hi! I have a question can I have a Halloween party? write me a note thank You! Mandy !!!!!! p.s. x's & o's

After 45 minutes on personal correspondence, Christi and Mandy are ready to move on. They are both avid Internet explorers and have found that it's more fun and more productive to explore together. Mandy was born in Alaska; today they choose to travel electronically to Alaska to find out what they can about Mandy's birth state.

Christi and Mandy's interactions are a testimony to the importance of a social context for reading and writing. These preteen girls use telecommunications to extend their on-going social chitchat. Not only do they use e-mail to maintain their relationship, their use of e-mail adds another dimension to their relationship. Working together on their research about Alaska is another social activity the girls enjoy. In this scenario, the girls are meeting their own social needs and are simultaneously engaging in extensive reading and writing. When a classroom is structured to take advantage of the social nature of language and language learning, students are more likely to see their reading and writing as purposeful and important. Since children learn to read by reading and to write by writing, opportunities for enhancing reading and writing abound in the electronic world of cyberspace.

The final profile highlights how a virtual nonreader and nonwriter became an excellent researcher when left to his own devices.

Profile Three

Dear,alice
halow good biy
Love,Mike

Mike, Age 8, September 26, 1994

Dear alice
I rot miy penpal
from mike

Mike, Age 8. October 5, 1994

Mike is small for his eight years. Quiet and unassuming, he maintains a low profile so that he doesn't call attention to what his mother calls "his reading problem." He strives to be very independent and maintains an "I-can-do-it-on-my-own" attitude, which is characteristic of many of the boys in his class. Had his mother not specifically warned me of his reading problem, I would not have easily identified a problem in this area. Mike, it seems, has developed excellent coping skills that have helped him disguise his struggles with reading.

Mike seldom asks for help and is quite content relying on his own devises to accomplish his goals; he finds help by an outsider to be an interference. If I try to help, he puts his head on his desk and refuses to interact with me. Taking this as my cue, I leave him alone and interact with him *only* when he asks for guidance. He wants to explore the Internet on his own—in ways that are comfortable to him, not in ways that work for me. Mike's strategy is to go after pictures—and go after pictures he does. As a sports enthusiast, he finds pictures of Babe Ruth and other baseball celebrities, Joe Montana and his football team, every famous basketball player to grace the NBA, and on and on and on. I am amazed each time I come into his vicinity and see another colorful image on his computer monitor and a never-ending grin on his face. Mike can find things on the Internet that others don't even know exist.

After several weeks of gathering pictures, organization becomes a problem. With icons for more than 40 different pictures on his desktop, things are getting too chaotic for Mike to deal with. When friends ask him to show them his great Kevin Johnson picture, he can't find it in his wide collection.

"Alice, is there a way to put these in piles so I can find stuff?"

"Do you mean like storing all your baseball pictures in one place and all your cars in another place?"

"Yeah. How do you do that?"

I demonstrate to Mike how to make a folder and then how to place files in that folder. One demonstration is all he needs. Thirty minutes later, he's created seven folders and has organized all his pictures and documents within folders:

1 1 1 1 1 1 1

Mike's Mike Mike Mike's Mikes Mike Mikes

Carz Basball Futball SUNS aliens hocky Baskitbal

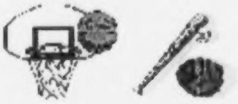
As his daily reading of information on the Internet increases, his writing improves as well. His emphasis remains on graphics rather than text, but within a few weeks, Mike is willing to take risks and begins work on his newsletter article. His four drafts are shown below:

Draft 1

The thang I lick abot Vronika is the pithrs.

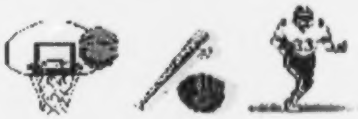
Draft 2

The thing I like about Veronica is the pictures.



Draft 3

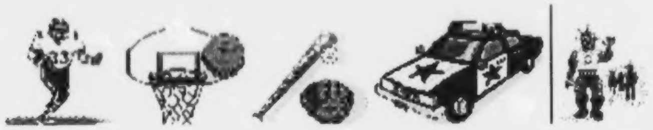
The thing I like about Veronica is the pictures. I can see football cratoon car's basketball karate pedlice cars pedatora and alot more



Final Draft

All About Veronica
by Mike Andre-Santos

> *The thing I like about Veronica is the pictures. I can see football, cartoon, cars, basketball, karate, baseball, police car, predator, and alot more.*



The End

My enthusiasm is reflected in my e-mail messages to Mike:

October 17, 1994	Did you enjoy exploring the Internet today? I think it's fun because you always find something you didn't expect. It's full of surprises!
October 23, 1994	I'm so proud of you. You've taken to the Internet like a fish to water. You did a super job of writing down the LONG route you took to find your information. You're turning into a great researcher!
November 2, 1994	I think I will name you the "Internet King"! You really had a great time finding sports pictures on the Internet. Congratulations on your great finds. I'm proud of you.
November 14, 1994	I'm SO PROUD of you! You've found a way you like to explore the Internet and gather information—and you're really going for the gold!

Mike demands independence, and I am wise enough to give him the latitude he demands. And so, Mike, the nonreader, becomes Mike, the researcher.

Had my Telecommunication Workshop resembled a more typical elementary school classroom, I can only guess at how badly Mike would have fared. His success story became possible because mine was not a single-text, highly teacher-controlled classroom. Mike is a bright and inquisitive child who discovered that a graphics-rich environment suited his needs much better than a text-rich environment. He became one of the most facile users of the Internet because he found a searching method that worked for him and perfected it to an art form. He collected Internet images like other children collected baseball cards—and he was envied for his fine searching skills and his great collection of pictures. When Mike was given the latitude to learn in his own way and at his own pace, his learning far exceeded my most grandiose expectations.

Concluding Thoughts

> *I have LEARNED e-mail and I have sent e-mail*
> *messages to President Clinton, my class and Alice.*
> *Linda, Age 11, June Newsletter*
> *If you put all the pictures, documents and information I*
> *gathered*
> *in one book you would have a book 1/2 inch thick!*
> *And it would take you 1 day and 1 night to look through all*
> *of it.*
> *Laurie, Age 9, December Newsletter*

When reflecting on the entire experience of the Telecommunications Workshop, the children commented most frequently on two topics: how much fun they had had and how much they had learned. Learning and fun had not been equated for them before. They thought of school as work and play as fun, but they had never characterized school work as fun. This novel idea was expressed most poignantly by Linda during an interview we shared. When I asked if there were any differences between school and our workshop, she replied without hesitation. "School is 'work-work' and what we do here is 'fun-work.'" Lemke (1993) suggests that "what we today marginalized as 'informal education' will become tomorrow's norm as it is already impossible to justify any particular selection of information as THE curriculum" (p. 8). Linda was the spokesperson for the other children when she called our "informal education" fun-work and simultaneously reported, "I learned so much more in our workshop than I do in school."

Technology and telecommunications can potentially enhance literacy and shift control from a central authoritarian figure or institution to the individual. This shift would encourage (a) risk-taking, (b) open-ended exploration, (c) shared responsibility for learning and decision making, and (d) extensive opportunities for authentic reading and writing.

For children to be truly engaged in their own learning, they must have the freedom to choose those materials most appropriate for themselves as learners. As an educator who espouses a feminist pedagogy, I do not presume that all children will be equally interested in my chosen topic; nor do I presume that they will all learn with equal ease and success from one textbook (carefully chosen by a district textbook committee); nor do I presume that using one source of knowledge (i.e., a single textbook) helps children become expansive thinkers who question ideas rather than accept them as the only way of viewing a given topic. Hence, I encouraged the children in my Telecommunications Workshops to choose their own topics of study and to find their own resources on the Internet.

Children took ownership in their research because they had chosen their topics of study. And they added to their knowledge base in the way that was most comfortable to them. As second through fifth graders, their literacy levels diverged considerably. The range varied from nonreaders to expert readers capable of understanding almost anything they found on the Internet. This range was reflected in how the students went about their research. Those children, like Tony and Mike, who had not yet developed literacy skills chose to gravitate toward pictures, sound bites, and movie clips; those who were more experienced readers, like Christi and Mandy, were more comfortable with written text; but they, too, were interested in graphic images they could capture from the Internet.

Feminist pedagogy, I believe, can give teachers the theoretical framework that will enable them to move into the future, Lemke (1993) suggested in his essay "Education, Cyberspace and Change." He affirmed that students learning in cyberspace are no longer reading from textbooks but from authentic sources; they are learning not what someone else thinks they should know but what they choose to know; they are exposed not to a single controlled version of the truth but to as many versions as they wish to investigate; and finally, they are not evaluated on whether they have learned the content of a textbook, but instead they form value judgments about the worth of what they have learned. In short, the computer and telecommunications have the potential to erode the traditional classroom organization and create a new structure where teachers and students are actively learning together, where power is shared among all participants, and where the use of technology and the Internet become highways to enhanced literacy.

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General Session: Technology Training/Staff Development

The Trouble With Troubleshooting

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Key Words: troubleshooting, technical repairs, technical strategies

Troubleshooting is valued in all lines of work, but how do you learn the skill? For many people it is like swimming—you either learn quickly or you drown. You can also learn from experts and become quite skillful. In this presentation you will learn proven strategies and techniques used by the pros that can be applied in almost any field, as well as hear how it is integrated in curricula.

The Department Of Labor says that employers value employees with thinking skills who can analyze situations and develop solutions and alternatives. Teachers are faced with the challenge of helping students learn important content as well as stimulating them to think about ways to apply the knowledge. Teaching troubleshooting make sense because it combines application of knowledge with thinking skills; activities can be constructed to involve individuals or teams; assessment can focus on process and rationale as well as final results. Knowledge of troubleshooting methods has value beyond the classroom. Educators using instructional technology are often confronted with equipment problems that may appear baffling. The examples used in this presentation will demonstrate the application of strategies that are used in solving information system problems.

The techniques and the examples are drawn from both technical training classes and field service experience; in addition, the methods are used in many classrooms to build knowledge and skill. There are ways to handle bounded or unbounded problems—in a familiar or unfamiliar domain. The strategies will include heuristic, logical, expedient, probabilistic, spiraling, binary, detouring, and counterintuitive. The presentation will provide guidelines for choosing the most appropriate strategy. Teachers and technicians alike will find this session helpful. Next time you are faced with a problem to solve, don't throw up your hands—use the ideas from this session and teach them to your students.

General Session: Curriculum Design/Strategies

Redefining Literacy With Multimedia Technology

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Key Words: multimedia, literacy, music, urban education, teacher education, multiculturalism, secondary education

The printed word remains the primary focus of school curricula and instruction, despite the predominant role of television, film, radio, and recordings in the lives of learners. New technologies available now in many schools, however, offer the possibility of student expression in media that were once tools of a small elite.

How might progressive language educators create learning activities that acknowledge the role of the mass media and at the same time help students find their own voices in the face of ubiquitous media hype?

"Music Talks" aims to introduce an expanded meaning of literacy into the school curriculum that goes beyond traditional text-based instruction. The project works with middle and high school students in activities that introduce Web page authoring to combine writing in a creative project with the use of music and graphics.

The short-germ goal of "Music Talks" is to demonstrably improve the language skills, attitudes toward learning and school, and overall self-image of an urban underserved high school population, including African Americans, Latinos, and many immigrant cultures. The longer term goal of the project is to create a working model of student-centered teaching and learning on which to base teacher education. Hypertext and hypermedia tools such as Web pages, digital sound recording and editing, and use of pictures and graphics, all hold tremendous potential for increasing student interest and involvement. Through reflective practice with these tools, the project aims to provide ways to fundamentally rethink the approach to language learning.

In a pilot project at Jersey City's Snyder High School, members of a class of culturally diverse ninth graders were asked to bring in songs that were important to them in some way, present these songs to their classmates and explain why they were important, and then write a short essay expressing their feelings about the music they had chosen. Excerpts of their music selections were turned into sound clips, and photos of each student were taken and scanned in as graphic files. Then the students combined their essays, photos, and sound files into a personal Web page using the Web authoring features of Microsoft Word 7.0.

A noticeable outcome of the pilot study was a marked increase in enthusiasm for a project centered around writing. Working on the Web pages enabled participants to gain technical skills utilizing personally relevant artifacts of popular culture. The issues that arose in the essays included poignant and often painful tales of personal loss, inner city violence, abuse, and aspirations, issues that too often have had no venue in the classroom. The essays can be found at http://aci.jcstate.edu/musictalk/snyder.html.

General Session: Exhibitor Session/Educational Reform and Issues

Building Local and Wide-Audience Knowledge Networks

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Key Words: knowledge building, Internet, collaboration, community, research, scaffolds, problem solving

Building Local and Wide-Audience Knowledge Networks

What is a knowledge network? It is probably very close to your picture of the "ideal classroom." A knowledge network is a synergy of human thought and action, a classroom-wide collaboration toward one goal—the creation of knowledge. It is a self-sustaining community of knowledge producers. Each student within the network is a contributing member—adding to and learning from a growing body of knowledge. While most educators would agree that a communal approach to knowledge—student collaboration, group work, responsibility for learning—is important, the reality is that the collection, organization, and dissemination of knowledge still resides primarily with the teacher.

In a true knowledge network, students engage in a way of thinking and learning that depends upon progressive and aggressive problem solving—making "stretches" in competence and hence new advances in understanding. Knowledge advances are public so that the entire group benefits, each person siphoning off what is useful and applicable to the individual and collective goal—the production of new knowledge. Knowledge Forum, a second-generation CSILE product, provides the organizational and cognitive structure for these networks to flourish.

A synthesis of cognitive research and technology, Knowledge Forum is a collaborative database. Students create notes to represent their ideas and submit them within the public "view." All notes are a part of the public domain and become interconnected as students use them to seek information and solve identified problems.

In many classrooms students write papers for the teacher alone. In Knowledge Forum classrooms, students write for themselves, their peers, and their teachers. This shift leads to a different kind of written expression, one in which writing becomes an authentic means of communication. Students focus as much on the process of learning as on the product. In an environment of ongoing discussions, students construct a network of interrelated ideas, and they are encouraged to think of themselves as active contributors to the class's growing knowledge base.

Students can build on the notes put forth by other students. They can easily embed quotes from other notes within their own notes (citation information is automatically added as live-link footnotes). Students can also collect notes of interest and save them in a folder as part of their own note. Each of these methods of linking facilitates a different intention in the construction of knowledge.

Students learn to think of knowledge as artifacts that can be constructed—artifacts that are autonomous and can be improved. This evolution of thinking about knowledge comes naturally as students posit new theories, comment on the theories of others, refine their own theories, and watch as their ideas evolve and transmogrify.

In addition, Knowledge Forum's "scaffolds" support social and cognitive operations. Processes such as reading, theory building, and debating are supported and made explicit through the user interface. Students post notes and label the contents with "supports" that indicate whether a note (or part of a note) is adding new information to a discussion, or requesting more information on some topic, or proposing an alternative explanation. Teachers can specify the "supports" that seem most relevant to a discussion. The (optional) act of prefacing (part of) a note with a support encourages the student to reflect on his intention. This, in turn, helps the student develop a deeper understanding of critical thinking and knowledge construction.

Students are encouraged to reflect on their ideas, as well as on the progress in their own thinking. This is supported by the "rise-above" note, which enables the student to gather her notes and write a summary of how her earlier thinking evolved into her current understanding of a particular interest.

There are many ways for students to add to their knowledge network. There are also tools for navigating through the knowledge network. Links (e.g., build-ons, quotes and collections) are all "live" and provide direct access to the connected notes. Students can also add problem types and keywords to their notes to suggest groupings of a less formal nature. Students can search for notes by various attributes (such as author, title, support, problem type, or keyword). Students can also search for notes by creation date or by date last modified. The knowledge base keeps track of each time a note is read or modified, and by whom. This allows students to search for notes they have not read or to search for notes that have changed since they last read them.

This presentation will introduce Knowledge Forum and how it can be used to build local and wide-area knowledge networks. You'll see how students can use it to formulate problems, seek answers, and monitor a growing base of knowledge. If you are interested in forming intellectual communities within and across your classrooms, if you are interested in learning centered around ideas—not tasks or activities or problems of the week, but around core concepts—then you'll want to know more about Knowledge Forum.

General Session: Special Needs

Emerging Technologies for Teaching and Learning of Students With Disabilities

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Key Words: assistive technologies, students with disabilities, access to learning, assistive workstations

> The department of Academic Computing and Media is committed to ensuring that all students have access to technology. To fulfill this commitment we have established six assistive computer workstations in our labs for use by students with disabilities.
>
> In addition to providing access to the standard software available in the labs, these workstations have been equipped with assistive software and hardware devices. Students with disabilities ranging from learning to mobility, hearing, and visual disabilities will find these workstations suitable to complete computer-related tasks. Work areas are partitioned to reduce visual and noise distractions. Training is available to students registered with the SSD office. Each student's needs are assessed and then matched with the appropriate software and hardware necessary to utilize available lab resources.

Hardware:	**Description:**
AirMouse	Allows remote control of the computer cursor position and easy selection of menu functions. $200 for PC, $280 for Mac
Closed Circuit TV	Provides text magnification of books and other printed material. $2,500
Cassette Player	Provides access to Readings For the Blind cassette recorder. $300
Datalux space saver keyboard	The keyboard has rearranged key clusters and compressed rows, allowing shorter reach and easier access for students with mobility impairments. $135
IntelliKeys	An alternative keyboard with easy-to-slide-in overlays that modify the keyboard to match your personal needs. $400
Juliet Braille Printer	Document printer that prints text in Braille. Text is converted to Braille by the program MegaDots. $5,000 w/sound enclosure
Ke:nx	A hardware device that allows you to connect alternative input devices, such as switches and alternative keyboards. $1,750 w/complete access package
Key Largo	An alternative keyboard designed to work with Ke:nx, with keyboard overlays designed for easy access. Overlays may be customized by the user. Price included in Ke:nx.
OpenBook	Scans and digitizes text into computer format. Hewlett-Packard IIIp scanner included. $2,400
TouchWindow	Allows direct input by touching the screen. Allows direct interaction, which focuses attention on the learning task, not the mechanics of using a mouse or keyboard. Price included in Ke:nx.
TV/VCR Combo	Provides a place to view videotapes with open/closed caption and descriptive video service. $430

Software:	**Description:**
Co:Writer	A word prediction program for those who struggle with writing due to language delay, learning or physical disability, or for those learning the English language. The program works with any word processor or text program to make the writing process easier and faster. $350 for Co:Writer and Write:Outloud
DragonDictate	A dictation program that allows you to dictate text and enter numbers, make changes, and format your work directly into application programs. You can control Windows functions, accessories, and applications entirely by voice. $625
HandiCODE	Complete, effortless PC control via Morse code input using any external single-, dual-, or triple-switch interface. $400
JAWS	Reads aloud the screen output. $800
KeyREP	Provides both word prediction and abbreviation expansion. Word prediction is a powerful and flexible feature that predicts the completion of words that you begin typing. This reduces the total number of keystrokes and helps with spelling. Abbreviation-expansion lets you create abbreviations of letters that expand, after typing, to words or phrases up to 750 characters. $300
Magic Cursor and Head Mouse	When used with a head-pointer, allows you to perform all mouse button functions, hands-free. Allows complete control of the computer by dwelling over an item and making slight motions. $2,200
outSPOKEN	A screen reader that transforms Windows into an audible interface accessible to blind users. Conveys information about what is on the screen through speech output and allows navigation of the screen with the use of keyboard commands. $500
Write:Outloud	A talking word processor that includes a talking spell checker. Provides multisensory learning and positive reinforcement for writers of all ages and ability levels. Seeing and hearing written work helps increase writing independence and quality. $350 for Co:Writer and Write:Outloud
ZoomText	A screen magnification software that allows 2x–16x magnification. Free on campus.

Furniture:	**Description:**
Adjustable Height Table	Tables are easily adjusted to usable heights with the crank. $460
Partitions	Provides usable work space by reducing distractions. $300 per cube

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Paper Session

Learner in Charge: Student Inquiry and Technological Literacy

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Key Words: technology, Internet, World Wide Web, student inquiry

This study examined technological literacy patterns and the process of inquiry in a student-centered summer program designed around inquiry and Internet utilization. Five case studies consisted of various configurations of fifth-grade students from a variety of educational backgrounds. A qualitative approach to research was implemented using grounded theory and the constant comparative method of data analysis. Data in the form of observational field notes, transcripts of video, and audio tapes resulting from each summer session revealed interesting findings regarding emergent technological literacy, "computer talk," work patterns, and the inquiry process. Pronounced differences between male and female participants showed variation and specific preferences to project design, inquiry, Internet utilization, and group configurations. Results of the study are offered to classroom teachers as implications for instructional practices in computer-enhanced classrooms.

Current Practices in Classroom Technology

The tools human beings have for obtaining information and solving problems have drastically changed across this century. Technological innovations in the areas of occupations, transportation, and communication have had an enormous effect on education. The urbanization and industrialization that so attend the American way of life that began in the early part of the century continues today. In the forward to his futuristic book, Gates (1995) suggests that we are beginning another great journey. We aren't sure where this journey will lead, but it is certain to touch many more lives. The major change coming will be in the ways people carry out their jobs and communicate with each other. However, even though computers and various pieces of hardware are present in most, if not all, schools, the cultural change accompanying earlier educational innovations has not yet taken place for technology in most classrooms today.

While visiting local schools and classrooms, it was observed that the small amount of equipment currently in classrooms is too often turned off, disconnected, or layered with dust. The teachers who are utilizing their machines usually structure computer time with programmed software, such as games, or drill-and-practice packages. Computers, though visible, are not sufficiently in use and they are certainly not doing the job they could do. Technology for the most part remains on the periphery in most classrooms. Recent research has revealed that computers are still commonly, and sometimes only, used for word processing (Downes & Fatouros, 1995; Grunberg & Summers, 1992). A large number of teachers remain apprehensive regarding computers and computer-enhanced instruction while their students continue to embrace new technologies in out-of-class settings, making schooling appear even more useless and irrelevant to the lives of young learners. Still, computers are being purchased in large numbers by school systems. The availability of classroom computers has increased from approximately one computer per 125 students a decade ago to approximately one computer per 15 students today (Dyrli & Kinnaman, 1994). Networked computers are becoming as common as maps, globes, dictionaries, and encyclopedias in many classrooms. Computers with Internet access are available for students to provide information and to assist them throughout the learning process.

In terms of student research and problem solving, the Internet-connected computer has the capability to take students far beyond the classroom. The amount of information each student can access is essentially infinite. Selecting, managing, and organizing this expansive amount of information is becoming crucial to the student learning process. With the level of comfort students display regarding technology, the enthusiasm they exhibit at the prospect of computer time, and the availability of computers with Internet access, several questions surface regarding the process of examining what teachers need to know and how students can learn from being exposed to a school situation where computers, the Internet, library resources, and a lab-type setting were available to assist with individualized student-generated inquiry.

Examining Technology-Driven, Student-Generated Inquiry Practices

A need for the study was evident as a result of the sheer number of computers with Internet access that were being placed in classrooms in urban, suburban, and rural settings across the state. Prompted by two statewide initiatives in Tennessee, computers with Internet access became part of every elementary, middle, and high school classroom. The first of these initiatives—the 21st Century Classroom Program—started more than four years ago. This competitive program matched state and local school district funds to provide selected teachers with $20,000 worth of hardware and software for their classrooms. The second initiative—The ConnecTEN Project—matched curriculum with telecommunications and technology. It focused on integrating the curriculum with technology instead of employing computers solely for rewards and enrichment. As a result of the ConnecTEN Project, every school in the state gained access to the Internet. As ideal as it may seem, teachers still struggled to create environments for students that would allow them to use computers effectively, let alone work with the Internet for enhancing learning.

The purpose of the study was to examine, document, analyze, and provide a rich, thick, and dense description of how students access information and what organizational processes they employed while utilizing the Internet as they engaged in their own individual inquiry pursuits. Using a qualitative approach outlined by Bogdan and Biklen (1994), the researcher became a participant observer in conducting five case studies consisting of upcoming fifth-grade students selected from a purposive sample in a lab-type setting. The students were engaged in individual, self-generated inquiry with the assistance of networked computers, peers, teachers, and all other resources available in the school and community. Data sets were collected through observational field notes, transcripts of video and audio tapes of each session, student journals, and photos. The project was constructed as a Summer Technology Institute and was offered at a local elementary school where parents frequently seek summer educational opportunities for their children. Observations and data collection spanned a four week period. Library access and a collection of electronic research materials such as electronic encyclopedias, electronic atlas programs, and various other CD-ROM programs designed for student research provided students with additional research material as needed. The following questions framed the study and provided the researcher with the following set of overarching themes:

> How do students use the computer and the Internet to assist in their own research/inquiry pursuits?
>
> What patterns of technological literacy emerge as students engage in inquiry?
>
> What do teachers need to know and do to support these processes?

Findings, Conclusions, and Implications for Classroom Instruction

In reflecting on methods of research and the process an inquirer follows, Boyd (1961) writes that Charles Kettering once suggested that research is nothing but a state of mind, a friendly, welcoming attitude toward change, and an effort to do things better. One of the initial questions that framed the study converged on what teachers needed to know in order to support student-generated inquiry and promote technological literacy. This question implied a focus on change. The change, aimed at common instructional practices, would provide students with the opportunity to engage in self-generated inquiry. In an attempt to offer classroom teachers insights into the process of student-generated inquiry, general findings are presented in the chronological order in which they occurred. As data collection took place, the researcher recorded daily reflections as a means of gaining understanding as well as compiling a list of implications for classroom teachers. In addition to daily entries in an observational field journal, videotapes and audiotapes of each session provided additional information to aid in understanding the nature of student interactions with peers and computers.

The first major finding that emerged as early as the first pre-institute interview session was that students were apprehensive and shy regarding sharing opinions and interests. The entire group sought teacher approval and were reluctant to grasp the freedom bestowed upon them as participants in the project. For example, during the first pre-institute session, when asked "What do you think would be important enough to find out more about?," a student participant answered, "I'm just a kid, I don't know what's important."

During the first pre-institute session it became even more obvious that students were not accustomed to having the freedom of choice being offered. Many had difficulty putting interests down on paper and asked approval-type questions. This gradually changed as the project progressed. Given encouragement by both the researcher and teacher participant, a slow change took place. Even with the amount of freedom and encouragement students received, by the end of the study several were still apprehensive and cautious at best regarding self-dependence and confidence. Most, however, were comfortable with the freedom and ventured out beyond the teacher-approval mode.

There seemed to be a lack of trust that caused this apprehension, as well as a lack of experience with the type of setting presented. To the end of the study, students remained in a state of disbelief regarding the amount of choice they were granted. This concept emerged as an interesting finding given the fact that this particular group of students received public school instruction in many different states and schools before enrolling at the site school, which prompted the researcher to conclude that student freedom of choice regarding instruction is not a common practice in elementary schools.

Another major finding was that after the second pre-institute session, where students became familiar with the Internet, Netscape, and simple navigation, one could not differentiate between students who had prior placement in a technology-enhanced classroom and those who had no prior placement. In fact, those who were never in a technology classroom were more apt to attack simple computer problems, conduct searches, and offer assistance to others. One student who had been in a technology-enhanced classroom in both second and third grade was visibly confused and frustrated when typical computer problems presented themselves in the course of a session. There was some difference, however, between students who spent a large amount of time on home computers and those who did not. With the exception of the one student with no computer in the home, students who spent a larger amount of time using their home computers emerged as the "experts" in assisting students, offering suggestions, and conducting in-depth searches. The emergent technological literacy they brought from home had more of an impact on student processes and progress than the level of emergent technological literacy they brought from experience within a classroom setting where a computer was present.

This phenomenon could have been partially attributed to the fact that in the nonthreatening home environment, problem solving is natural, whereas in the classroom setting, computer use is most often programmed. The conclusions and implications regarding this finding are twofold. First, students have a large amount of choice when using a computer in their own home. This choice is typically not an option in the regular classroom setting. While there is value in sound educational software games, most of these games do not lend themselves to spontaneous problem solving or a great deal of student choice. Second, even with multiple computers in a classroom setting, students are still limited to what they are allowed to do on computers. Examining data collected from parent and student interviews, it was concluded that most of the activities students engaged in within the 21st Century Classroom environment or with computers in the school setting in general consisted of games or drill-and-practice. Activities were most often teacher-driven and not student-generated.

One can therefore conclude that although the experience of being in a technology-enhanced classroom is exciting and valuable, the type of computer utilization students encounter in these classrooms does not offer the spontaneity needed for problem solving and inquiry. The study created a simulated version of the home environment in terms of the degree of opportunity for student choice within a classroom setting, implying that students can operate and function at a maximum level within a student-driven environment. Implications for future software purchases are tremendous here. Students reported that they liked the games they previously used but preferred the Internet activities. It is important that this be considered when making purchases.

Perhaps the most glaring finding was the distinct differences in computer-related behaviors between female and male participants. Beginning with the first summer session, videotapes and field notes showed that female students sought help from the researcher and teacher participant at a ratio of 14:1. Videotapes of the first session showed that females raised their hands for help 14 times for every time a male participant asked for help. Females did not leave their computers but stayed in their seats, while male students got up and walked to the researcher or teacher participant. This of course enabled the male help seeker obtain help more quickly. Male participants often sought help from other students, whereas female participants would wait for the researcher or teacher participant for help. When asked about this, one female participant told the researcher that if you asked another student, the student may not have the answer, but if you asked the teacher, you were sure to get the answer, and the right answer at that. As the study progressed, female participants asked for help less and less and were able to solve problems on a regular basis. Appearing at first to be apprehensive and reluctant about problem solving, female participants logically sought help from what appeared to be the most knowledgeable person in the room. Encouraging female students to trust themselves has important implications for classroom teachers.

Male participants were more likely to take risks and venture out to visit all hits from search results. Females, however, most often only visited the first 10 sites offered by the results. Female participants also visited fewer sites. When asked about this, female participants all said that they read the descriptions, visited the sites, found what they wanted, and stopped, instead of continuing. Female participants also told the teacher participant that once they found what they wanted, they preferred to use the information instead of seeking more. Therefore, even though at first glance it appeared that female participants were not covering as much ground as males, they were methodically searching for specific information, locating the information, and applying it to their projects.

Moving Forward With Technology

The project offered students opportunities to engage in self-generated inquiry and to utilize the Internet within a nonthreatening, student-centered environment that promoted technological literacy. To further clarify, the nonthreatening environment within the study can be described as a student-centered environment where learners had complete control in terms of selecting topics for research, designing a project, choosing materials for the project, utilizing the Internet without formal direction, and presenting their completed projects using student-selected methods. Findings from the study showed that students need a specific environment in order to thrive and develop the skills needed to operate in a technology-driven world. Time for thinking, conversing, and movement are essential in this environment. The ability to choose and select topics of interest, develop work patterns, and operate within a self-selected group configuration allowed students to move through the inquiry process naturally.

The amount of time students spend at a computer or in a technology classroom (a 21st Century Classroom as defined by Tennessee Department of Education, 1994) has no bearing on the development of technological literacy. Instead, it is the type of tasks engaged in that develop literacy. In a 21st Century Classroom, software selection is most often haphazard and consists mainly of drill-and-practice programs. The home environment, however, is different because at home the learner is usually in charge of the learning situation. Therefore, the home computer environment seems to have the most impact on the amount of emergent technological literacy a student brings to a classroom. Sharing, assisting, and offering expertise are essential components that must be present in a technology-enhanced classroom.

To better prepare today's students for the technology-driven world they will be part of in the future, educators must examine current instructional practices, past instructional practices, software purchases, and technology implementation. The study showed that it made no difference how many years a student was placed in a 21st Century Classroom. That experience had no impact on the inquiry process, nor did it have an impact on any technological literacy patterns, work habits, or utilization of the Internet. However, the instructional practices, the nonthreatening environment, the encouragement provided by the teacher participant, and the allowances made for each student's particular preferences seemed to have the most influence on the process. With the abundance of funds allocated for classroom technology, software, and computers, it seems that these things are essential in developing the type of classroom environment needed by students who will be leading us into the next century.

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General Session: Teacher/Professor Productivity

Teachers Connect

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Key Words: lesson plans, Web site, professional resources, online journals

Teachers Connect is a gateway to educational resources. The purpose of Teachers Connect is to provide a site where educators can find resources to help them in the profession and enhance their classroom teaching. It contains Tried & True, Forums, Web Resources, Connected Classroom, Calendar of Events, Behind the Scenes, Special Programs, and Professional Resources.

Tried & True lesson plans are tied to North Carolina Standards and are submitted by North Carolina teachers.

Forums connects teachers so that they can share technology projects, provide policy input, and create a statewide network of support. Web Resources are researched by North Carolina teachers and are categorized by subject area.

Special Programs spotlights state programs (such as the North Carolina Teacher of the Year, Christa McAuliffe, and the Milken Family Foundation) that honor teachers and promote their accomplishments. Professional Resources gives educators access to grant resources, professional organizations, journals, and specific state employment information. Connected Classroom, an online journal, offers projects and reports from teachers across the state, tips from teachers using technology in their classrooms, Web sites reviewed for quality, special teacher features, and overviews of successful technology staff development models.

Poster Session

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Key Words: solar systems, galaxies, student research

Fifth-grade students at Jefferson Elementary School in Springfield, Illinois, are engaging in research on the solar system. Students are using printed materials, the Internet, laserdiscs, and CD-ROM programs to aid them in their understanding and knowledge of our solar system. Students are involved in using e-mail and teleconferencing capabilities with an expert in the field of astronomy. Joseph Kolecki is associated with the NASA Lewis Research Center and has recently worked on the Mars Pathfinder Mission. He visited Jefferson School during the last school year, and students have continued to correspond with him via e-mail. His enthusiasm and e-mail connection, along with many Internet sites, including NASA's, will enhance the preparation made by the students to develop their own new solar system projects.

Exploring New Galaxies is a cross-curricular project, with an emphasis on science. Students are researching our current solar system, and they are studying the weather, distance, land formations, and characteristics of each planet. Throughout the researching phase of the project, the students are teleconferencing with Joseph Kolecki and other fifth-grade students who are studying the solar system. The students are able to share information with each other through technology.

After researching our own solar system, students will work in cooperative groups using their creativity and knowledge to develop their own solar system. Requirements for Exploring New Galaxies include names for each planet, details of physical features, size, characteristics, and other information that justifies their models.

The classroom will be transformed into a showcase of a unique universe the students have created. Each group will give a detailed presentation about their own solar system. They will explain their model and conduct a question-and-answer session.

The research aspect of this project will take two weeks. Students will then work two weeks on the actual design and presentation of their project.

Workshop
You Want This Network Completed When?

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Key Words: network, hardware, budgeting, fiber, technology plans

School technical directors are being asked to take on large projects that were not even dreamed of when most of them were in college. These same projects would be handled by teams of specially trained professionals in a business environment. Learning to plan, organize, and pay for these projects is a challenge that schools need to be able to meet.

The planning process involves tremendous research. The information given out at this workshop should help others reduce the time spent on this stage of the process. Intensive on-site research into where a school currently stands with technology should be compared to where the school community and leaders want to be at the end of the technology initiative. Involving teachers by asking them to make a commitment to use the hardware they receive both with the students and for their own productivity is another successful strategy. Research on the Web can help to project needs and costs, as well as brand names to pursue. Also, the workshop will help you learn about items often forgotten in a tech budget that need to be included!

The ordering process can involve intensive bidding from companies dealing in hardware and software. Find out what to look for if you are selecting a company to help you order, set up, and maintain your hardware and software in order to optimize spending and productivity.

Setting up the network is very time intensive. Our technical expert will give you the inside scoop on helpful software and hardware to get the network up and running efficiently. Installing the computers is another time-consuming task. Get tips on how to mobilize volunteers to help expedite the process. See how to organize a database to keep track of the installations, serial numbers, and other data.

Bringing up the network is something that needs time. Get ideas on how to organize this into a step-by-step process that runs smoothly and efficiently.

Introducing faculty to networks, hardware, and software issues needs to be done in a carefully structured manner. Get lesson overviews, ideas for scheduling faculty classes, and creative solutions to working with faculty members who have a broad range of needs. Explore a variety of educational uses for a database on the network, such as attendance and student records. See how a school intranet and Internet can be used to meet a variety of needs.

Evaluating the process is intellectually challenging. See our school's three-year plan to implement this technology initiative, and learn how we are budgeting to keep the plan going. Review our plan for maintaining, repairing, and replacing hardware and software.

Workshop

Tips and Techniques for Developing Internet Projects

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Key Words: Internet project, curriculum, collaboration, technology, K–12, student research

TIES, Technology and Information Educational Services, with a number of partners, has been exploring the development and delivery of online, collaborative, classroom curriculum projects for students in Grades K–12. These partners include the Minnesota Historical Society, the National Park Service and Voyageur's National Park, the Raptor Center and Bell Museum at the University of Minnesota, the Wildlife Science Center, the Archeological Network, Macalester College, and the ROOTS Program. Some of the projects are being evaluated by the North Central Regional Technology Consortium (NCRTEC).

Project-based learning is widely accepted as an effective and highly engaging instructional approach for student learning. Add to that approach the use of technology to extend and enhance project activities and the result is even more powerful. Online collaborative projects fit in this category.

A good classroom curriculum project is developed around the following:

- Goals with specific, measurable outcomes linked to standards
- Assessment demonstrating student achievement
- Students seeking possible solutions to a problem
- In-depth investigation of a topic
- Student research
- Activities reflecting identified best practices

- Timelines that allow for flexibility and serendipity
- High student interest in the topic

A number of information literacy skills can be developed and strengthened through project work. These include:

- Research/reading
- Recording observations
- Interviewing experts
- Evaluating accuracy and value of information
- Summarizing information
- Making predictions
- Presenting conclusions to an audience

Technology can play a variety of roles in the project experience for students. The World Wide Web and e-mail replace traditional means of communicating with people and open up a world of expertise, interviews, and collaboration never before possible to students in the classroom. Internet and multimedia resources expand the information resources available for research, including access to databases of public information about the environment, communities, and the universe. Spreadsheet, database, graphic, and modeling tools assist in the recording, organizing, and manipulating of data and allow students to represent information in a variety of formats. Desktop-publishing and presentation tools give students the ability to create professional-looking products to share their conclusions with their audiences.

In beginning the project-development process, there are several questions to ask yourself:

- What are you hoping to accomplish (goal, standard, etc.)?
- How will you know if students have achieved the goal?
- Will this project enhance or replace traditional curriculum?
- Will this be a local project or include other students and teachers?
- What is the source of the content?
- What resources are available?
- What is the timeline?

- What expertise do you need to access?

There are several model online projects that teachers can use to guide the development and use of projects in the classroom. These include:

- The Journey North (http://www.learner.org)
- MayaQuest 98 (http://classroomconnect.com)
- Wandering with the Wolves (http://ties.k12.mn.us/wolf)
- Discover Minnesota (http://ties.k12.mn.us/discovermn)
- Bald Eagle Nesting Project (http://ties.k12.mn.us/eagle)
- Footsteps to Freedom (http://ties.k12.mn.us/footsteps)
- Digital Eye (http://ties.k12.mn.us/digitaleye)

Spotlight Session

The Arrival of Virtual Schools: A Threat or an Opportunity?

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Key Words: virtual schools, reform

Why is technological literacy/fluency such a big deal?

A story about Kim:

- We failed Kim.
- Why?

So what is the problem??

From the American Association of State Colleges and Universities: "A new report (by this organization) reveals that two-thirds of the 230 institutions surveyed either have or are considering computer-competency requirements for students." (*Chronicle of Higher Education*, August 11, 1995, A17)

From the Information Technology Association of America: "A report (by this organization) warns that one out of every 10 jobs requiring information technology skills is going unfilled due to a shortage of qualified workers." (*Chronicle of Higher Education*, March 7, 1997)

From Larry Irving, U.S. Department of Education: "By the Year 2000, 60% of the new jobs will require technological fluency. Right now, only 20% of our current workers have these skills." (at KETC in Louisville, Kentucky, March 7, 1997)

Why?

- The world has fundamentally changed
- Change today, status quo tomorrow?
- Constant, relentless change!
- Graduates must feel comfortable with Communication Age tools. They must access, use, evaluate, apply, and communicate info and resources that exist outside school.

So what do they need?

- basic computer survival skills
- basic word processing, database, and spreadsheet skills
- basic understanding about technology
- ability to access, process, and organize info in context
- integrated computer literacy/fluency should be goal

Question: Are students getting these basic skills in their current schools?

- If not, why not?
- What are parents' responses?

Imagine if you will:

- a school with no kids
- kids with no schools

A story about Ralph:

- no boundaries
- funding for enrollments (dollars go with the student—"show me the money")
- the birth of virtual schools
- funding for home schooling versus virtual schooling
- a tough decision for school districts

Where are we going?

- What are virtual schools?
- How do they work?
- Do they work?
- How can/should we respond?

What Are Virtual Schools?

Schools without walls

- kids at home
- parents helping out
- teachers online (electronically and in "real time")
- teacher visits/support

What a concept—for students and their parents

- no transportation problems
- no lunches to pack
- no bullies
- no bad hair days
- no "right" clothes
- no peer pressure

What a concept—for teachers

- no supervision
- no discipline problems
- no ironing shirts
- no set hours
- no commuting

The good

- this is cool!!
- no pressures
- individualized learning using 20th- and 21st-century tools

The bad

- little structure
- if it doesn't "work"—back to the school that you left for a reason
- reliance on technology

The ugly

- what about the nasty stuff on the Internet?
- who is controlling where the students "travel"?
- the security of the equipment

How Do Virtual Schools Work?

Three models

- home schooling with an edge (one teacher)
- electronic correspondence school (two teachers)
- multiple teachers, courses

What is similar to all models?

- student with computer, modem, and Internet access
- student working from home
- teacher as guide and resource

The home schooling model:

- curriculum coverage driven by parent
- home schooling with a computer and easy access to a teacher (online, fax, or phone)
- ratios—56:1 is not uncommon

The electronic correspondence school model:

- students completing "electronic versions" of correspondence courses
- lessons, assignments, and tests provided by and marked by two teachers
- teachers monitor and assist students as required
- parents as supervisors and helpers
- teacher as monitor
- ratio—30:1 common

The multiple teachers/courses model:

- similar to high school model
- student deals with multiple teachers for a variety of subjects
- all subject matter original from teacher
- ratio—30:1 common

Do Virtual Schools Work?

From the *Globe* and *Mail*:

- "Many of the 35,000 Canadians who teach their kids at home are welcoming (virtual schools), are making the most of the new technology, and getting the encouragement of governments and school boards to hook up."
- "My kids could conceivably not set foot in an educational institution again."

From the Massachusetts High Tech Web site:

- "Administrators in the Hudson public school system are gearing up to use their $7.4 million federal grant to create online courses for a Virtual High School Consortium on the Internet."

Demand is high:

- waiting lists
- anxious calls
- going from a "take one and all" to a "take the best" model

How Can/Should We Respond to Virtual Schools?

Three options

- ignore them
- compete with them
- improve what you have

Ignore them

- lose funding
- others will not do this
- a pretty smug approach
- what about the Swiss watch makers?
- they were taking *all* students, now they want only the best
- how will that leave your school??

Compete with them

- start your own virtual school (or share one)
- copy what works well
- add some new ideas
- promote your program
- if you build it well, they will come
- but—another school, administrative challenge
- is this what you need or want?

Improve what you have

- what are they offering that you are not?
- what is appealing?
- how can you improve?
- home access to your system
- parent buy programs?
- electronic feedback
- open-ended courses—work at your own pace and/or challenge students
- involving parents in a meaningful way

My conclusions

- for now, virtual schools are here to stay

- for some students, they offer a workable alternative
- either start your own or steal the ideas and approaches
- ignore them and perish

For further information, please contact: Thornburg Center for Professional Development.

General Session: New Curriculum Design/Strategies

Making Thinking Visible

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Key Words: concept maps, images, knowledge

Did you ever stop to think about whether we can even think without images? Even though most of us would answer, "Of course not!" philosophers and cognitive psychologists have struggled with this question for centuries. John Locke thought that generalities, in particular, were troubling, since they eluded clear visualization. Picturing "triangle," for example, is difficult. Is it three-dimensional, equilateral, or solid? It is precisely because we all visualize, and see different pictures in our heads based on our experience and assumptions, that the pictures we draw "between us" are critical to communication about what we understand.

Drawing makes thinking visible. When we pick up a pencil to draw directions, ask someone to "paint a picture," or say "I can't quite see what you mean," we are trying to close the meaning gap by bringing form to the content. So what about abstract ideas? In his book *Visual Thinking*, Rudolph Arnheim (1969) describes how images make meaning. A "picture" makes a statement about the visual qualities of something. A "sign" stands for the content or points to it, without representing it visually, and a "symbol" portrays the abstractness of an idea. Ideas, even abstract ones, can be mapped symbolically. And those maps may actually be more valuable than the replicas or representations of reality we can make to understand where we are going or what someone is saying because they suggest, rather than state, meaning.

Representing ideas with symbols, using lines to show relationships, and making it all fit together into a map helps us make sense of our own ideas and those of others. These maps make elegant statements about how ideas fit together into complex systems. It is the logic of these images and, at the same time, their incomplete representation of the ideas that makes them perpetually interesting to those who create them and those who view them. As "thinking made visible," they invite questioning, discussion, and revision.

By getting the ideas out of our heads and on to paper or a computer screen, we can begin to play with how they fit together, to look for relationships, to form ideas into systems, and to wonder out loud. We learn about what we know and what we don't yet know. We discover connections that were not within our grasp before. We begin to weave a tapestry of meaning between our ideas.

How do you use concept mapping in the classroom? Teachers, administrators, and students take to visual mapping as if they were hard-wired to do it. In fact, that's the case Tony Buzan, author of *The Mind Map Book* (1994), makes for using mind maps to:

- make choices
- organize your own ideas (note-making)
- understand other people's ideas (note-taking)
- brainstorm
- improve memory
- create a group product

Quoting 19th-century brain researcher Sir Charles Sherrington, Buzan says his metaphor was more accurate than he could have imagined: "The human brain is an enchanted loom where millions of flashing shuttles weave a dissolving pattern." Images occur where the neurons embrace, and the right and left hemispheres connect. Mind maps help us to mimic the complexity of thought by weaving images and words together. We connect form and content through tinkering with how the ideas fit together.

When we draw mind maps, diagrams, flow charts, storyboards, and action plans, we are making models of connections, sorting them out, making them explicit, and testing them. These maps become works in progress, benchmarks of our thinking. This is the stuff writers, artists, and inventors talk about—ideas beginning to take on a life of their own, learning from the ideas as they evolve, discovering, uncovering, recovering ideas. Great thinkers use mind maps instinctively to delve the deepest recesses of their brains for interesting, surprising, and revealing connections.

We can benefit from using concept maps. For curriculum mapping, getting diverse groups to work together, organizing a portfolio, teaching a new concept, summarizing a set of ideas, brainstorming, prewriting, outlining, creating a plan, or a dozen other uses, computer-generated mind maps are fun and flexible to use. For individuals, they provide a powerful organizing and reflection tool over time. For groups, they provide a focus for the group effort, encourage conversation, and support the evolution of ideas. The technology takes this powerful tool and makes it even more enticing through the flexibility of an endless white board, a huge library of symbols, and the ability to link maps.

How do you get started? Getting started is easy because the programs are friendly and the ideas are in your head. Getting good is painless because you will almost immediately begin tinkering with your map to make it better represent your ideas. Using it with new groups, disciplines, and grades is natural because whether you are working alone or in a group, thinking out loud helps to clarify ideas. Sound like a different kind of reform? This "no pain" strategy can allow you and your students to use concept mapping as the "prime mover of constructive imagination" (Ribot, 1926).

Concept Mapping Allows Us to Imagine With Conviction!

By representing our ideas with symbols and phrases, we objectify them, separating ourselves from them so that we can examine them critically. This is essential to overcome the "cognitive dissonance" (Ausubel, 1968) identified as blocking new but inconsistent information. Mapping has a curious way of making us open to new ideas, perhaps fundamentally, because it forces us to use a different format.

Making thinking visible also helps with the social construction of knowledge. Vygotsky (1962) suggested that one of the critical ways we construct meaning is by learning with others who can recognize when we need help. By making our conceptions visible, those in our "zone of proximal development" can clearly see where to provide input to help us develop our ideas more clearly. Both peers and teachers can contribute to pushing our level of understanding to new heights when they can see where we are struggling to define ideas in the context of other ideas.

Concept Maps Are Construction Sets for Ideas

They are fuzzy enough to be more like play than work and at the same time precise enough to make us want to tinker with them endlessly. They beg for completion and yet resist finality because, like art, their symbolic representation of abstract ideas invites interpretation. They represent our most profound understandings because they are so easy to make, and yet they show us what we do not know through the rigorous mapping structure that demands parallelism, consistency, and logical connections. They are time-eaters for both teachers and students, and yet they are highly prized, posted, and shared.

As Nicholas Negroponte (1995) writes in *Being Digital*, it is difficult to tell whether we have more effect on the world through the technology we create, or whether it has more of an effect on us and how we think. Digital concept maps are both our creations and our teachers, and so perhaps allow us to do the most powerful learning we know how to do—take what we know, question it, and push it to where we did not yet know we needed to go.

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Workshop

JAVA Beans, the Classroom, and Beyond

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Key Words: emerging technologies, instructional change, teaching methodologies

This workshop will focus on the use of the latest technologies in the classroom. Learn about classroom use of the latest in software, Internet resources, and software that makes use of online connections.

Throughout the workshop, participants will enjoy a variety of learning experiences, such as demonstration of products, interaction with the session leader, group discussion, group activities, problem solving, and hands-on experiences with products. You'll go away from the workshop not only with their own ideas about the use of emerging technologies but also with a packet of information (and some door prizes).

The session will begin with a description of some of the emerging technologies and why school personnel should be paying attention to them. Emphasis will be placed on the fact that educators do not have to be technological specialists or experts to understand and use software, telecommunications, and hardware that will enhance the educational experience for their students.

A portion of the session will feature learning to use one of the products that uses JAVA beans. Participants will see how students in Grades 3–16 might use the technology as they learn content and concepts in the traditional academic curriculum. Examples of lessons and projects featuring the technology will be given, as will ideas relating to teaching methodology. Those attending the workshop will help session leaders brainstorm ideas for bringing this type of software into the regular school curriculum.

During this part of the workshop, participants will discuss the following statements:

- A significant problem that seems to impede use of new technologies in regular classrooms is teaching methodology.

- Perceptions of what a classroom should be and how students should be taught revolve around the teacher as the provider of knowledge.

- The new technologies give impetus to bringing about change in classroom teaching and require students to take a more active role in their learning.

- Through use of telecommunications and new software, the traditional academic curriculum is not ignored but enhanced.

- Current emerging technologies will (not can) make a difference in our classrooms.

Spotlight Session

The Potential of Virtual Reality to Improve Education

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Key Words: science education, virtual reality, learning technologies, immersion

Imagine launching and catching balls in an environment with neither gravity nor friction. Imagine creating and altering electrostatic fields, releasing charged particles to be propelled through those fields. Imagine manipulating atoms and observing the forces created when molecules bond. Then, as a giant step further, imagine being able to directly experience these phenomena by becoming a part of them "inside" a virtual world: being a ball as it bounces, riding on a test charge as it moves through an electrostatic field, becoming an atom as it bonds. These are the kinds of learning activities enabled in the virtual worlds of ScienceSpace. Our research suggests that such immersive, multisensory experiences enhance students' abilities to conceptualize and integrate complex, abstract scientific ideas.

Our work explores the strengths and limits for learning of a very powerful emerging technology, virtual reality (VR). However, Project ScienceSpace does not focus solely on developing educational worlds using an interface that enables multisensory immersion. Our studies are exploring new ideas about the nature of learning based on the unique capabilities for research that virtual reality provides. ScienceSpace worlds enable unique, extraordinary educational experiences that help learners challenge their intuitions and construct new understandings of science. Our evaluations are designed to examine various aspects of these learning experiences, processes, and outcomes. Sophisticated experimentation along these dimensions is critical to determining the educational potential of three-dimensional, sensory-immersive virtual environments, a medium that the entertainment industry will place "under the Christmas tree" within the next decade.

ScienceSpace Worlds

ScienceSpace consists of three worlds in various stages of development: NewtonWorld (NW), MaxwellWorld (MW), and PaulingWorld (PW). In NewtonWorld, users experience laws of motion from multiple points of view. In this world with neither gravity nor friction, balls hover above the ground. Users can become a ball; they can see, hear, and feel its collisions; and they can experience the ensuing motion. In MaxwellWorld, users build electrostatic fields and manipulate multiple representations of force and energy. They can directly experience the field by becoming a test charge that is propelled by the forces of the electric field. In PaulingWorld, users learn about molecular structure and chemical bonding. They can explore the atoms and bonds of a simple molecule such as water and can manipulate the amino acids of complex proteins such as hemoglobin. Images of these worlds are available for viewing at the ScienceSpace Web site (http://www.virtual.gmu.edu), which includes other images, articles, experimental results, and videoclips.

The interface of our immersive, multisensory environments is typical of current high-end virtual reality. ScienceSpace's hardware architecture includes a four-processor Silicon Graphics Onyx Reality Engine2 graphics workstation, Polhemus magnetic tracking systems utilizing a stylus or 3Ball (a three-dimensional mouse), and a Virtual Research VR4 head-mounted display (HMD). Sound is produced by a Silicon Graphics Indy workstation and is experienced via HMD headphones and external speakers. Vibrations are delivered to a subject's torso using a "vest" with embedded subwoofers. This interface enables us to immerse students in 3-D virtual worlds using the visual, auditory, and haptic (touch and pressure) senses.

Four issues are critical to our evaluations of these VR worlds:

> *The learning experience.* The VR experience can be characterized along several dimensions. We focus on participants' subjective judgments of usability, simulator sickness, immersion, meaningfulness of our models and representations, and motivation.
>
> *Learning.* We are interested in both the learning process and in learning outcomes. To assess learning outcomes we examine mastery of concepts at both the "descriptive" and the "causal" levels using multiple measures (e.g., conceptual, two-dimensional, and three-dimensional understanding).
>
> *The learning experience versus learning.* Our focus in this contrast is to understand the relationship between the

virtual reality experience and learning and to identify when the VR experiences help or hinder learning.

Educational utility: This contrast centers on whether, for particularly complex and abstract domains, the virtual reality medium is a better (or worse) teaching tool than other pedagogical approaches. We compare the quality and efficiency of learning among different alternatives of varying cost, instructional design, and teaching strategy. In particular, we compare our learning outcomes to less-complex technology-based scientific modeling approaches, such as 2-D "microworlds."

Significance of This Research

Within the next decade, the video game industry will develop devices capable of multisensory immersion ubiquitously available in rich and poor homes, urban and rural areas. To compete with the captivating but mindless types of entertainment that will draw on this power, educators will need beautiful, fantastic, intriguing environments that also foster deep and effective learning. Project ScienceSpace is beginning to chart these frontiers, as well as reveal which parts of VR's promise are genuine and which parts are hype.

In the long run, research on multisensory immersion will also produce another important outcome: a deeper understanding of the nature of human learning. As biological organisms, our brains have evolved very sophisticated mechanisms for comprehending three-dimensional spatial environments that provide input on various sensory modalities. To date, however, these "perceptualized" learning capabilities have provided little aid in mastering phenomena whose causes are abstract, complex, or counterintuitive. Being a worker and citizen in the 21st century will require comprehension of sophisticated scientific content, material most people do not learn through the best of the instructional approaches available today. Through the types of representations and learning activities Project ScienceSpace is exploring, insights are emerging into how we can leverage the full capabilities of the brain—and advanced information technologies—to attain this type of learning.

General Session: Curriculum Design/Strategies

Computer Mastery and Cold Fusion: A Dynamic Web-Based Curriculum

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Key Words: computer mastery, dynamic Web design, curriculum design, cold fusion, basic skills

The Computer Mastery curriculum has been designed specifically for delivery via the Web. Its interface guides students through a sequence of seven levels of skill development and assessment from Macintosh basics to simple Web page construction. Attendees gain insight into the power of Web-based delivery for certain course content, as well as begin to understand how to integrate databases into their Web design using Cold Fusion. The presentation is broken down into the following five parts.

Introduction

The session begins with a history of the Computer Mastery course itself and the rationale behind choosing the Web as its form of delivery. There is then a brief discussion regarding the nature of Cold Fusion database interactivity and its impact on designing curriculum for the Web.

Student Perspective

As the student interface of the site is explored overhead, those functions supported by database interaction are highlighted and their importance to the student discussed. Most of these utilities are otherwise not available in a more traditional classroom model, or even from standard "static" Web curriculum design. The highlights include such services as personalized user environments, direct access to individual course information (e.g., password, ID, e-mail address), "live" quizzes with immediate feedback, collaborative exchange through a "chat" feature, progress indicators, instructor feedback, and a secure working environment. A quick demonstration on how to build your own online quiz using Cold Fusion is included.

Instructor Perspective

A tour of the instructor (administrative) interface to the site emphasizes the ease with which the instructor can now manage the course. The primary advantage discussed is the organization of student work and assessment provided automatically by the Web site. In previous non-Web iterations of this curriculum the instructor was mired down in administration of the varying levels of student completion and questions. The new environment has eliminated nearly all of these problems. Commenting, progress reports, student information, site security and content, and chat review are available to the teacher from anywhere there is Internet connectivity.

Curricular Gains

By utilizing dynamic Web-based delivery, such features of the curriculum as a student-centered, self-paced environment are facilitated, multiple learning styles are easily addressed, and exploration and discovery learning are inherent.

Questions and Discussion

There will be 10 to 15 minutes left at the end for questions and general discussion.

General Session: Curriculum Design/Strategies

Tools and Templates for Terrific Standards-Based Curriculum Units

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Key Words: student projects, Web-based programs, curriculum

How can you incorporate the Internet into your curriculum in meaningful ways? We will share resources and engaging units created in San Diego with a U.S. Department of Education Technology Innovation Challenge Grant.

Participants will come away from this session with URLs for standards-based curriculum units developed by teachers in San Diego City Schools' Triton Project. We will share tools and templates for curriculum development based on the WebQuest model designed by project partner Bernie Dodge, Professor of Educational Technology at San Diego State University. Additionally, we will offer a Web-based outline for staff development that Bernie Dodge has created to integrate the curriculum development process.

Web-based resources used in the project support dynamic curricular activities that feature collaboration among students and teachers, teach important skills for tomorrow's information-based workplace, and help to bring unique and timely information into the classroom. Common to these inquiry-oriented units is their emphasis on authentic problems that require students to analyze a body of knowledge deeply, by creating an exhibition to which others can respond.

Examples offer teachers a way to manage students' access to information on the Web and focus valuable computer time on student learning. In many of the projects, students are guided to resources that represent specific points of view on important issues. Students are then required to share and interpret the information they gather and develop a broader understanding of a wide range of perspectives.

The Triton Project is a multipartner educational collaborative that integrates technology with the standards-based education reform efforts of the San Diego City Schools to create new learning opportunities for students and teachers. Triton features a unique ocean-themed curriculum that utilizes the capabilities and unique appeal of modern technology to capture interest in core curricula, provide a highly interactive education program, and produce improved student achievement in elementary and secondary schools throughout the district.

This program includes strong staff development and evaluation components that are woven into ongoing curriculum development and implementation. A major focus is the development and dissemination of content-based and standards-driven projects that integrate the use of technology as a tool for learning. The program stresses systemic reform; works with other district initiatives, such as the San Diego Urban Systemic Initiative; and contains elements that are in compliance with recommendations of state and national calls to reform, including the Goals 2000 Act.

General Session: Technology Leadership

Supporting a FAT Technology Program With a SLIM Support Staff

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Key Words: staff development, networks, network management, servers, Internet, training

With no full-time technology support in school buildings, learn how a large school district has developed successful support methods that create independent users. As the amount of technology increases rapidly in schools, necessity demands that we "teach them how to fish," rather than "giving them fish." Empowering teachers and staff members to solve their own problems and support their own needs has become crucial in today's rapidly escalating technology implementations.

Information and resources must be instantly available for this empowerment to occur. Without the right tools and instructions within immediate grasp, frustration rapidly sets in for end users. The solutions that have been developed by Lincoln Public Schools Instructional Technology Department will be shown in this session.

Topics include:

- A comprehensive Instructional Technology Web site for technology coordinators and computer teachers that provides valuable troubleshooting aids, downloadable software and training guides, computer purchasing information, calendars of training and meeting schedules, and an online monthly newsletter with timely topics (http://www.lps.org/computing/IT/).
- The use of online forums and listservs.
- Innovative training methods and special staff development, including a "computer liaison certification program."
- How the district provides more than 22,000 hours of teacher technology training per year.

- Supporting more than 2,800 e-mail accounts with at-home dial-up services for Internet access.
- Pressing custom CDs used for installing district-licensed software, Internet software, system software, and other utilities.
- How network servers are managed throughout the district.
- Tips for managing computer labs, including using the network management software, ANAT; and security software packages, At Ease and FoolProof.

Question-and-answer time will be provided throughout the session.

General Session: Exhibitor Session/Curriculum Design/Strategies

Cooperative Learning and Technology

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Key Words: cooperative learning, communication, assessment

> True cooperative learning involves more than simply putting students into groups. It also involves more than taking turns with a limited resource, like a computer. Collaborative learning succeeds when students within a group really depend on one another. It's not just a matter of waiting for the smart student to do all the work; everyone needs to be engaged and contributing. Communication is the key. When students talk to each other, explain content and concepts, and negotiate a common understanding, strong, powerful learning is the result.
>
> This kind of cooperative learning can support education across the content areas, and technology can help. This workshop examines ways that multimedia can support successful collaborative instruction.
>
> The presenter will model a variety of cooperative learning approaches that actively involve participants. Teachers will see how mixing media can give students unique and essential information, how controlling the flow of data can reinforce a valid division of labor, how distance can be a great way to bring students together, and how it can all be assessed.

National Educational Computing Conference 1998, San Diego, CA

General Session: Educational Reform

Open Learning in K-12: Policy and Implementation Issues

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Key Words: distance education, distributed learning, information technology, teacher training, education leadership, funding, legislation

Distance education is changing. For more than 100 years distance education has depended on print as the primary strategy to bring courses and programs to remote areas and to independent learners. Information technology now allows us to transform traditional distance education development and delivery formats. We can now offer new kinds of courses, programs, and resources, and produce and deliver them faster and with higher quality than ever before.

Increasingly these educational services are being distributed to clients in urban and campus settings where geographical distance is not a factor. Hence, open learning is a more accurate description of the evolving use of technology to provide educational services.

The architects of today's school system did not contemplate education delivery through a variety of synchronous and asynchronous technologies. Similarly, funding systems and school facilities policies are designed from the point of view that education will occur in classrooms, in schools, and within local school district boundaries. Today's technology makes these systems and policies less meaningful and potentially obsolete.

This paper provides a brief summary of the strategic and policy decisions that led to the creation of the British Columbia Open School and the immediate implementation challenges this new enterprise faces. Before considering the key policy decisions, however, a brief description of the Open School is in order.

The British Columbia Open School

The Open School was created by the British Columbia Ministry of Education, Skills and Training in 1997 through a merger of the Ministry's Technology and Distance Education Branch (TDEB) and the Schools Programs Division of the Open Learning Agency (OLA). Historically, both the Ministry of Education and the OLA have developed distance education programs, albeit for different audiences. This consolidation enables the province to have one center, at the OLA, with overall responsibility for distance education services. It also combines the expertise of the two organizations in the areas of instructional design, broadcast television, multimedia development, and educational telecommunications networks.

Open School has taken the lead role in coordinating the design effort of an open learning model for British Columbia schools. It is a catalyst, a tester, and a change agent with a mandate to demonstrate how new materials can be designed, delivered, and supported. Open School is demonstrating how teachers can be trained to work in this new environment. And, it is demonstrating how new courses and learning resources can be packaged and delivered for use by learners, parents, schools, and other partners using a distributed learning model.

Open School is designing an open learning model that will combine the best of interactive technologies with pro-active teaching and mentoring processes. Open School is implementing an electronic delivery system that provides increased opportunity for meaningful collaboration among learners, teachers, and content experts.

Open School is providing mechanisms for teachers and mentors to convey curriculum content in multiple ways, and to design and identify systems that actively involve learners in both the acquisition and creation of knowledge.

Although access to a greater range of relevant, technology-based programs by British Columbia students is a primary reason for establishing the Open School, the province has been interested in the ability of the Open School to influence the education system in ways that result in both increased learner success and more cost-effective delivery of services. As a result, the Open School has a mandate to extend the boundaries of distance education in British Columbia to include a variety of forms of school-based distributed learning approaches and to provide consultation in ways that will help to reduce the need for new school construction.

Strategic and Policy Decisions

The creation of the Open School rests within a series of decisions concerning overall technology directions for the British Columbia K–12 education system. Providing technology-based educational courses and programs requires access to technology and telecommunications services, and, above all, trained educators.

In 1989, the British Columbia Ministry of Education, as a part of its education reform agenda, established the Education Technology Center (ETC). This center was to provide technology training and support for the K–12 system and to engage in research and development concerning educational uses of telecommunications technologies. The center successfully developed and implemented the Community Learning Network (CLN), an Internet-based information and e-mail service for educators. Although a large number of people use the network and its Web site receives a significant amount of attention (more than 5 million visits a year), by itself the network has not been sufficient as a way of ensuring classroom-level technology integration and support.

In 1993, the Ministry of Education established a multistakeholder process to develop a provincial technology vision and plan. Earlier attempts at technology planning initiated by the province were directed at school and district acquisition of hardware. After a two-year process, the province released the School Technology Plan. This plan provides school districts with $100 million over five years in support of school district technology implementation. Key elements of the plan are a requirement for all school districts to develop technology plans and, over time, to have all schools develop such plans. The plan emphasizes the importance of embedding technology skills and learning outcomes within the school curriculum, establishing standards for school district acquisition of technology, supporting teacher training in the use of technology, and partnering with the technology industry to ensure that schools receive the best value for their money.

In 1994/95, the Province announced its intention to develop the Provincial Learning Network (PLN). This network is intended to interconnect all schools, libraries, postsecondary institutions, museums, and cultural institutions. It will significantly increase bandwidth access for schools and it promises to reduce overall costs for telecommunications for British Columbia schools.

For the past four years, the Ministry, through its TDEB, has initiated a number of technology industry partnerships designed to provide British Columbia educators with access to state-of-the-art curriculum-based software. Partnership efforts have centered on working with technology firms that were prepared to develop education-specific tools and content. This strategy has brought British Columbia to a point where school access to technology, educationally appropriate content and tools, and telecommunications infrastructures have converged in ways that will enable the 1,700 public schools in the province to consider new ways of delivering educational services.

Implementation Challenges for the Open School

Although well positioned to take advantage of British Columbia's investment in technology planning and infrastructure, the Open School faces a number challenges if it is to play a significant role in the future development and delivery of educational services in the province.

Teacher training on the appropriate use of technology remains an on-going challenge. British Columbia has an aging teaching force that, like many other jurisdictions, has not fully embraced education technology as a new opportunity to redefine teaching practice. Rather, technology is seen by some as a threat to job security. In addition, the magnitude of the task of training or retraining a teaching force of more than 30,000 is considerable.

The impact of the leadership in the use of education technology as demonstrated by the British Columbia Ministry of Education, Skills, and Training, British Columbia school districts, the Open Learning Agency, and the technology industry has not yet been realized fully. However, over the next year, the wisdom of a multifaceted, large-scale approach to education technology integration will be evident in British Columbia schools as funding and legislation issues are addressed to enable the implementation of the Open School.

General Session: Curriculum Design/Strategies

Technology and Girls: Curriculum Ideas That Work

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Key Words: history, gender, collaborative projects

Sample Student Projects

Stock Market Project. This project will be discussed in depth. Handouts describing the assignment, the assessment, and a bibliography of Web sites will be given. Participants will also have the opportunity to take a first hand look at finished products from the 1997–98 school year. This project is excellent for girls because it allows them to work with a partner and be as creative as they want to be while learning about technology and the business world all at the same time. Each group of girls selects three companies from the NYSE, the AMEX, or the NASDAQ to invest in and follow over an eight-week period. Each day, the girls monitor the progress of their stocks on the Internet using a variety of Web sites. The students record and report the progress of their stock as well as their profit or loss using a spreadsheet in Microsoft Excel. At the end of the eight weeks, each group will extensively research one of their companies and create a PowerPoint presentation to present their fellow classmates. Students are introduced to the stock market and its basic components. The project also enhances students' understanding of spreadsheets and formulas. While working with a partner, the girls are able to communicate and work together to produce a creative project and gain confidence in their research, organization, and presentation skills.

Other ideas and projects used in our math and science departments, as well as the grade level, include the following:

1. Using Microsoft Excel to average grades. Students use Excel to calculate their own averages. A list of grades and the maximum value of each assignment is kept in their notebooks. An average on the computer

is assigned every three weeks. One unexpected outcome has been that the students can vividly see the impact of a zero on their homework or a low test score. Handouts of sample spreadsheets will be given. Grade 7.

2. Using Mathematica for a review of area, volume, arc length, surface, and work. This project is assigned in the calculus class, and the girls work with a partner. The students learn not only how powerful Mathematica is, they also review concepts previously covered in class. Grade 12.

3. Using Microsoft PowerPoint to present ideas on topics ranging from severe weather (Grade 5) and animal behavior (Grade 6) to the effects of acid rain or of certain drugs on heart rate of water fleas (Grades 9–12). Girls use the Internet as well as library resources to gather their information. The students have the chance to work together and be creative with their presentation while also learning a great deal about their specific topic.

4. The Internet can be used to locate and interview scientists as well as research famous female scientists and mathematicians, carry on chats with female mathematicians and engineers, work monthly math problems with a team located anywhere in the country communicating by e-mail, and going to a chat room to ask for help on homework or to discuss any trouble areas. The Internet is a great source for "live" work. A list of Web sites, as well as sample pages, for all listed activities will be provided. Grades 5 and up.

5. Using hardware tools such as a motion detector, a temperature probe to measure boiling points and melting points, pH probes to study about acids, bases and buffers, and radioactivity gauges. Students then graph information on Excel or graphing calculators. Grades 7 and up.

6. Computer simulations using Logal Explorer to simulate situations such as genetics, sex-linkage, breeding studies, population growth dynamics, and physiological processes. These simulations are excellent because they enable students to study many generations without actually breeding anything. Grades 9 and up.

7. Using the Timeliner program to produce a geographical, mathematical, or biological timeline of events, creatures, or land development. Grades 5 and up.

8. Using Geometer's Sketchpad for ideas from proving theorems to constructing. Students are able to see why a theorem works. Grades 9 and up.

9. Graphing calculators and Microsoft Excel can be used to produce circle and bar graphs to demonstrate the probability of flipping coins. The calculators can also be used to produce linear, quadratic, and exponential regressions. Sample graphs will be given. Grades 7 and up.

Projects in Other Disciplines

20th-Century Decades Project. After using the Internet and various CD-ROMs for research, the girls use HyperStudio to create multimedia presentations on life in a particular decade. I will discuss this project in depth, provide handouts describing the assignment and the assessment, and show some examples from a zip drive. This project is particularly successful for girls. They enjoy finding out about life in a particular decade, not just historical events but also fashion, entertainment, cultural events, and social movements. They become engaged in the research, organization, and presentation of the material. What I found to be particularly interesting is that the stacks are all different: there is such creativity in the layouts, drawings, pictures, buttons, and organization. The technology used in this project makes their study of this historical period more exciting and more meaningful.

HyperStudio Presentations

French Fables
Famous French People
Poetry Notebooks—English Class
Mayan Civilization Project—Spanish ClassBody Parts
Projects—Spanish Class
Spanish Fairy Tales—Spanish Class

Use of Internet for Research

- History, English, and foreign language classes all engage the girls in Internet.

- Research and interactive learning sites. They enjoy being active learners.

In government class, in addition to researching U.S. Senators, the girls communicated with them via e-mail.

Excel

Students use Excel to create charts of information, e.g., comparing and contrasting civilizations in ancient history or battles of the Revolutionary War in U.S. history.

Laserdisc

Used in history classes for illustrations, drawings, primary source documents, and video clips; students also use the laserdiscs in presentations.

Web Pages Projects

Girls work collaboratively to design their own Web pages on different Ancient Middle Eastern civilizations in history class and Spanish holidays in Spanish.

Timeliner

Students use the Timeliner program to create timelines for various history classes.

PowerPoint

Students use PowerPoint to present research on a variety of topics, including the Bill of Rights, Roman daily life, Spanish influences in the Southwest, immigrant Americans, and African history.

E-mail Conferencing

Girls enjoy communicating electronically with their teacher in foreign language classes to practice the language and in history class to respond to questions about historical fiction. Sixth-grade geography students are currently doing an e-mail project with a Belgian school. The Belgian students have sent us penpal letters, a questionnaire, a little information about Belgium, and some pictures. We are responding and hope to have another letter exchange and follow-up questions.

Multimedia

Girls collaborate to create shadow stories, make videotape presentations, illustrate stories using digital cameras, and burn a CD-ROM in a guitar class using PageMaker for the lyrics on the jacket.

Word Processing

In addition to all papers and formal works being word processed, the girls are learning to scan visuals and adjust text in the word- processed essay so that photos or appropriate visuals can be scanned in. The girls enjoy designing and producing their school newspaper using Word.

WebQuest

In ancient history, the girls use a Web site called Sworn to Serve on WebQuest for their study of the Middle Ages. This site is at http://itdc.sbcss.k12.ca.us/curriculum/sworntoserve.html. Through interactive learning the girls become immersed in life in another historical period and learn about the different aspects of the Middle Ages.

General Session: Technology Training/Staff Development

Online Communities of Learners: Technology-Based Approaches to Professional Development

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Key Words: collaboration, professional development, online, curriculum development

In an effort to support the ongoing professional development of award-winning educators, the Milken Family Foundation developed an interactive Web site that allows for communication and collaboration between educators across the country. Believing that professionals must play an active role in their own professional development, the Milken Educator Virtual Workspace (MEVW) was designed to bridge space and time. The MEVW is an online tool to support and enhance collaboration between educators across the country. The MEVW provides such technological tools as a threaded discussion, simultaneous chat session, the means for collaboration by multiple users on a single document, a virtual file cabinet for storing files and Web sites, a directory of users, and easy access to the Internet and multiple Internet search engines.

This session will begin with a discussion and tour of this exciting new tool for educators. For two years, the foundation has used the MEVW as the central workplace of group projects that have included K–12 educators across all academic areas. To date, more than 30 projects have been tackled by small groups of educators with facilitation by the foundation. Currently, projects are being sponsored by such organizations as the Getty and National Geographic, while many others are being led by talented and enthusiastic educators.

Two projects currently underway will be highlighted in the presentation. Leaders of the online groups will discuss their group's goals. The first project, ECPlanting SEEDS for the Future, is based on the premise that the best teachers of teachers are other teachers. This group of six elementary-level science teachers utilizes the MEVW to implement a hands-on, minds-on EE science curriculum that incorporates cooperative learning, integration across subject areas, embedded assessment, and the use of technology in the curriculum. Teachers and students hailing from six different states shared scientific data on such topics as weather, water, vegetation, rocks and minerals, animals, and the night sky. Through collaboration on the MEVW, use of e-mail, and videos, students were exposed first-hand to the meaning of SEEDS: Scientists Experimenting and Exploring Diversity in States!

The second project presented is Project TEAM: Technology Engages Administrators and Motivation. For Project TEAM, 20 administrators are working together to examine a research question. The research project asks what motivates teachers to improve their teaching performance and impact student learning. Across the school year the TEAM created and validated survey questions that were then distributed to educators across the country by means of e-mail and fax. Completed surveys were collected from 120 educators and were then coded and analyzed by the TEAM members. It is the intention of the TEAM to present research findings for publication in professional journals and as presentations at professional conferences nationwide. Plans are underway for a second, broader data collection leading to an even greater understanding of this important educational issue.

These two unique professional activities are examples of the range of professional and collaborative projects possible when the obstacles of time and space are overcome with a technological tool, such as the MEVW.

General Session: Teacher/Professor Productivity

Standards-Based Integrated Curriculum Development

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Key Words: student achievement assessment, academic learning requirements

Measurable Achievement

Education is poised to take advantage of the collective knowledge of teachers and at the same time enable collegial collaboration in the creation of new and meaningful curriculum among teachers. The business world has been connected for years on local- and wide-area computer networks to increase productivity by connecting employees. Education is also big business, with the most significant product in the world. The bottom line for the business of education is student achievement.

The nationwide standards movement is a step in the direction of meaningful performance-based student learning. The notion of students performing and producing to prove their skill and knowledge level is being accepted as the norm for a basis of advancement through the grade levels. As a consequence, assessment is moving from norm-referenced standardized tests to criterion-referenced assessments with a significant investment in test scoring in order to accurately measure student learning. Instructional design will be the pathway from standards to student achievement.

Standards Drive Assessment

How student achievement is measured is changing. Many new assessment tools are based on student performance standards. This shift in assessment is having a tremendous impact on the delivery of instruction in classrooms. Teachers generally are good at teaching to the test. If the test changes, then teaching strategies will change. However, some studies have found little instructional change associated with the introduction of new types of testing when there is little or no professional training for teachers. While it could be stated that a better test means better teaching, it can't be said that teachers won't just adjust lessons to the test requirements and fail to impart core concepts to students. By clearly identifying the end result, the educational system has been given an identifiable target. Teachers can now align curriculum with the standards in order to prepare students for the 4th-, 7th-, and 10th-grade tests in Washington. For many teachers this means rethinking current curriculum. New approaches to curriculum design are based on solving problems, answering essential questions, designing student performances, or developing student projects.

Cycle of Reform

Educational reforms come and go. History shows that any reform effort is only as effective as the number of teachers who believe in the reform. The number of teachers who will carry out the reform is directly related to the ease and effectiveness of the implementation of the reform. Often reform efforts fail because they are too difficult, confusing, and time consuming for teachers to implement in the classroom. Experienced teachers will recall volumes of documents produced at great expense that were meant to head education in a new direction. Those same documents soon found the bookshelf or filing cabinet as their final resting place until the cycle of reform began again. This is one effort to assist teachers in applying and assessing the essential academic learning requirements.

Standards-Based Integrated Curriculum Development

Teachers in the midst of a standards-based reform movement are awash in a sea of documents. There are national standards, state standards, and district standards enclosed in one or more binders that sit on the shelves of many classrooms. Teachers are expected to create or adapt curriculum to meet those standards with little training and even less time for planning. The Standards-Based Integrated Curriculum Development program addresses the issue of standards-based curriculum design and delivery in the environment of a networked building or district. The power of teacher collaboration, whether face to face or online, to improve instructional delivery and student performance is enhanced by this process.

The goal is to help teachers connect with each other in order to collaborate and integrate curriculum while addressing learning standards. The current embodiment of this effort is supported through a grant from the Washington Office of the Superintendent of Public Instruction. In 1997 OSPI funded two projects, Standards-Based Integrated Curriculum Development and Senior Project Management. Both have been received very well at local, regional, and national conferences in the last six months. More than 150 districts in Washington state have downloaded the SBICD program since November 1. There are three pilot districts supported by OSPI this year to provide staff training and fine tune the process for wider use next year.

The SBICD program is a set of related database files using FileMaker Pro 3.0 or 4.0. FileMaker Pro 3.0 and 4.0 are cross-platform, serving both Macintosh and Windows client computers. The server software can run on either a Macintosh or Windows NT server. Teachers can access and work in this database environment over the Internet when the server IP address is open. FileMaker Pro 4.0 also has the ability to Web-publish databases, which means that units of study can be posted to a school or district Web page automatically without having to do HTML coding. A free, 30-day trial version of FileMaker Pro is available at http://www.filemaker.com/try_it/index.html.

The Process

The unit development process allows as many as five teachers from the same building or different buildings to create units of instruction based on one of six popular methods of curriculum development—Essential Question, Project-Based

Learning, Standards-Based Learning, Work-Based Learning, Problem-Based Learning, and Service Learning. Standards are identified through this process and associated with each unit. Teachers can see what other teachers are doing throughout the building or district. This encourages collaboration and sharing of ideas and expertise. The steps include:

- Designing the unit and selecting standards
- Designing assessments to measure student mastery of standards
- Selecting benchmarks of student performance that are components of each standard
- Designing activities to achieve the benchmark performances
- Designing a culminating event to allow students to prove mastery of standards
- Creating rubrics for student performances
- Identify teaching and learning resources
- Record notes on next time

This process creates a logical progression from broad to specific. The standards selected move directly to the assessment tools to measure student achievement of those standards. The standards transfer to the more specific benchmarks that will be addressed in the unit. The benchmarks progress to the activities page where activities are designed that directly relate to the benchmarks. All the activities and standards, then, lead to a culminating event that encompasses all the selected standards.

The rubric process allows teachers to easily and quickly create rubrics or scoring guides to meet the assessment needs of today's classroom. The rubric file includes student project ideas for written work, media, and performance. Descriptive terms based on Bloom's Taxonomy assist in designing the rubric to any level. Rubric criteria can also come directly from the attached Washington Essential Academic Learning Requirement file for Grades 4, 7, and 10.

The resource file allows teachers to catalog and attach pertinent resources to each unit for individual reference and would also be available to other teachers. Today's teaching resources include everything from the traditional (books, periodicals) to the next generation of CD-ROMs and Internet URLs. Teachers often spend hours on the Internet looking for relevant sites. This file allows the cataloging of quality sites that provide pertinent information.

The benefits for students include curriculum alignment both horizontally and vertically from one school to another. If a student moves laterally between schools there will be a consistency in the curricular approach because the teachers from neighboring schools had the opportunity to create units of study together. Curricular redundancy can be minimized as students advance through the grade levels vertically because the subject area teachers have the ability to work together on curriculum. Through the collaborative creation of rubrics by teachers, students receive the scoring criteria up front before the assignment begins. Publishing the unit of study to a school Web page lets parents and students easily access the project criteria and timelines for each course unit of study from home. The biggest benefit of this program for staff is that teachers can know the "what" and "how" of other teachers. Teachers no longer have to re-create the wheel when designing units or creating assessment tools. By building on the knowledge and experience of others, education moves forward.

In designing a new unit, teachers no longer have to start from scratch. Chances are a unit has been developed that addresses the critical content of a new unit. Teachers can quickly and easily find those similar units and build upon the work that has already been done. When the new unit is finished it goes into the "gene pool" of units and in turn becomes a future resource for others. Each June the best units from each district or ESD as identified by peer review would be sent to OSPI to be included in a "Best of the Best" resource that would be available online through the OSPI Web page and also available for download as a local district resource for teachers. Teachers can know "what" and "how" of outstanding curriculum design created by teachers within the building, the district, or the state.

OSPI has also supported the development of a Senior Project Management system consisting of a shared relational database that provides seniors with online guidance, resources, and direction in selecting, managing, and producing a high-quality senior project while meeting goals 3 and 4 of House Bill 1209. This process reinforces the student as the worker and allows the advising staff to coach. Students are guided to create, design, and produce a culminating project that proves student mastery of skills, problem solving, the application of knowledge, and conceptual learning. Seniors self-select eight Essential Academic Learning Requirements they will meet through the senior project. Advisors can easily monitor senior projects in terms of qualitative and quantitative criteria. Students input and interact with the process while teaching staff monitors and gives feedback through the evaluation standards.

Accountability to Standards

If students are to benefit from the Essential Academic Learning Requirements, then teachers need staff training in designing units that allow all students to achieve performance-based standards. School districts and school boards must be accountable to provide training in performance-based assessment, rubric development, and creating relevant curriculum that engages students in the achievement of learning standards. Trained staff then need to be connected in order to build the collective wealth of what "works." This investment in curriculum and assessment design will provide future dividends in the form of student learning.

General Session: K–16 Computer Science

Including Quality Assessment in Programming Instruction

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Key Words: programming instruction, quality, pedagogy, grading

I hate grading. I seldom get it done quickly. By the time my students' computer programs are graded, the instruction has moved on to another topic. When examining my feedback, (I believe) students seldom pay attention to more than the grade I have assigned to their programs—because the feedback is not immediate and because they truly seem more interested in the grade. Thus, students do not benefit as fully as they might from the comments I placed on their programs. My desire to provide feedback to students about program form and logic (the quality of their programs) is the reason it took so long to do the grading. What a vicious circle. I want to break out of it.

The goal of programming instruction is to get students to develop good programs. Our instruction, however, seldom explicitly addresses the qualities of a good program in the general sense. Also, we tend to restrict discussion of specific examples to the feedback provided via grading. We seem to expect students to learn the qualities of good programs merely by reading our feedback and seeing examples provided by the text and instructor. I believe such current practice could be significantly improved by including program evaluation as an explicit component of classroom instruction.

This presentation will have four parts: a rationale for explicitly including program evaluation in instruction, some possible instructional activities for addressing program quality, a sample rubric suggesting the qualities of a good program, and a discussion of personal experience in this area during the last year. A partial, more specific, discussion of all aspects of the presentation is given below.

While my dissatisfaction with the grading process provides significant impetus for this work, there is additional rationale for including program quality as an explicit part of instruction. I am very frustrated with my role (and the students' roles) when I stand up in front of the class and essentially tell them what the text says. There should be other, more useful instructional activities. Most curricula I have seen never specifically address program quality in an explicit and systematic manner. Thus, students could easily avoid attending to it. Finally, my model of learning and teaching suggests that if I really want students to be able to perform a task (e.g., write a program), then I should have them actually practice that task. Thus, if I want students to be able to check the quality of their own (or someone else's) program, I should provide them practice on that activity. Only by evaluating programs can students develop skill at evaluating programs.

To provide such practice is not necessarily a simple task. A significant problem is that the role I would play is somewhat new and uncertain to me. If, however, I can plan some concrete activities, I should have less difficulty.

Some possible activities are:

- providing multiple examples and solutions for students to use, each deemed to have good quality
- using actual excerpts from student programs to illustrate both positive and negative examples of quality
- small-group discussion of the characteristics of a good program
- large-group consensus-building as to those characteristics resulting in a rubric to be used in program evaluation
- using the rubric to evaluate student programs—this could be done in either small groups or large groups or both
- when grading, always check correctness and occasionally check quality, since quality is directly addressed in class. Providing good examples seems fairly easy. Using student programs as samples will need to be done carefully to avoid embarrassing students or treating some differently than others. Discussions will take some planning. Selecting which student programs to grade and incorporating that grading into the overall grading scheme will also require careful planning. None of these, however, seem to pose insurmountable problems.

Initial experience indicates that the instructor should discuss aspects of quality programs before expecting students to contribute to development of the rubric. Students can be involved, however, though several updates to the rubric may be necessary as student experience grows. The rubric would describe a good program and consist of a number of statements, refinements, and (perhaps) examples. The statements could start with the phrase "A good program …." Some possible completions to the statement are: "is correct," "is efficient," "is user-friendly," and is "easy to read." Each such statement would need to be refined. For example, a correct program: compiles and executes without runtime errors, produces correct results, accomplishes the prescribed tasks, and does not deviate from the original task in a detracting manner. Some refinements will likely require examples, e.g., refinements of "is easy to read." Additional ideas for characteristics of quality programs could come from the literature, for example, Kernighan and Plauger's *The Elements of Programming Style*.

General Session: Curriculum Design/Strategies

Transforming the Computer Lab Into a Cognitive Learning Environment

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Key Words: computer lab activities/skills, higher education, instructional computing, preservice teachers, teaching strategies, technology integration

Introduction

The challenge of instructional computing and the grooming of future teachers to integrate technology into the curriculum are at the forefront of educational reform initiatives taking place in most institutions of higher education across the country, with computers being the technology of choice. Numerous options have been presented and are available to facilitate an evolutionary change in educational environments that has been revolutionary in business and industry environments. Whereas the two environments are obviously diverse in nature, both have a major stake in the individuals who will constitute the workforce of the future. The level and spectrum of knowledge, skills, and attitudes these individuals will bring to the various workplaces of the future remain highly dependent upon many factors, including the needs dictated by business and industry environments. The pressures of change are forcing less debate in lieu of more action for restructuring literally every curriculum, especially those in teacher education programs. Suffice it to say, a strong word of caution is in order. The technology options for change in teacher education programs normally default to (a) the isolated computer course, (b) the concurrent attachment of computer lab sessions to an existing course, and/or (c) the option to use and model the use of technology in established teacher education courses. As such, what you do not want is for the integration of technology to mimic the training environments of business and industry.

The Question of Education Versus Training

Our most reliable sources have consistently provided us with a foundation for making decisions about when to provide education and when to provide training. Training is relevant to job/task performance and is defined as "the systematic development in a person of the knowledge, attitudes, and skills necessary to be able to perform adequately in a job or task whose demands can be reasonably well identified in advance and that required a fairly standardized performance from whoever attempts it" (Rowntree, 1981, p. 327). Education is "the process of successful learning of knowledge, skills, and attitudes, where what is learned is worthwhile to the learner and usually (in contrast to training) where it is learned in such a way that the learner can express his/her own individuality through what he/she learns and can subsequently apply it, and adapt it flexibly, to situations and problems other than those he/she considered in learning it" (p. 75). Changes in technology will force changes in society. The seamlessness of the technology will slowly but surely force us to change our attitudes about education versus training. At some point in the near future the overlap between education and training, which happens to be learning, may also become seamless enough that as technology is integrated into the curriculum, it will be difficult to determine exactly where education versus training begins and/or ends and vice versa.

As such, there may be many lessons both environments can learn from one another. However, at present it is crucial to understand that training is productivity-driven and meant to equip employees with new skills that will be applied immediately once they return to the job. Teacher education programs may have a strong need to impart basic computing skills to its students; however, the focus cannot exactly parallel that of business and industry for obvious reasons.

First and foremost, preservice teachers currently have at least a two-year delay from receipt of initial computer skill training to their actual entrance into the educational workplace. Second, use of the step-by-step skill development model of computer training as it exists in business and industry environment will have major limitations for preservice teachers because the steps for performing the skill(s) will change over time as software is upgraded. Third, whereas teachers will have productivity duties, their primary student interaction will be learning-driven not productivity-driven. Additionally, as more and more students enter higher education with basic computing skills, the creation of isolated word-processing-, spreadsheet-, database-, graphic-, presentation, or telecommunication-based documents may serve to improve personal productivity and/or reinforce basic computing skills but accomplish little toward preparing teacher education majors for the K–12 classrooms of the 21st century or helping them understand the big picture of instructional computing.

Using the computer in educational environments will require the use of the computer as a productivity tool and also as an instructional tool such that users not only develop and demonstrate better problem-solving, critical-thinking, and decision-making skills, but also seek to develop such skills in the students they will teach. How to use instructional computing to teach and reinforce these skills to teacher education majors while simultaneously showing them how to integrate the technology into the curriculum they will be teaching is the real challenge.

The Option for Cognitive Learning

The challenge before us is not unique to any one institution of higher education, nor is it simply an issue of education versus training. Faculty and teaching assistants within the Educational Technology Program at Purdue University are working together on a major project to transform the computer lab environment into one that facilitates cognitive learning experiences through scenarios-based computing activities. The motivation behind this project is a mandatory two-credit undergraduate course for preservice teachers slated for implementation in fall 1999. At present, enrollment estimates are in the neighborhood of 250–300 students per semester and will include approximately 16–20 concurrent computer lab sessions every week.

Pilot tests of several scenario-based computing activities over the past two semesters show an improvement over the current method in the following ways:

1. Faculty can now closely correlate the computer components to the class lectures and the course readings, thereby making the entire course relevant to the teaching experience.

2. Faculty and teaching assistants can now more effectively model instructional computing to teach and reinforce the higher level thinking skills that should be developed, e.g., problem solving, analyzing, critical thinking, and decision making.

3. Students can now use their productivity skills to interact with the computer and then transfer those skills to a variety of software applications, including education software, such that learning to use the computer as a supplemental tool becomes the emphasis.

Lastly, the scenario-based computing activities provide the students with the experience of creating a portfolio that contains examples of instructional computing projects that can be modified and implemented over time within a desired curriculum.

This curriculum strategy will be demonstrated so that attendees can see why it does a better job of preparing teacher education majors to integrate the technology than the basic computing skills method. And to experience scenario-based computing learning first-hand, following the demonstration attendees will have an opportunity to participate in solving one scenario-based computing activity and to brainstorm the development of one activity.

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Paper Session

Design of Technology-Based Learning Environments That Support Both Teachers and Students

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Key Words: constructivist, networked computing, training, family, partnership, support

Abstract

Many teachers across the country have seized on networked computing as a way to improve their effectiveness. Through such techniques as project-based learning and redesigning the classroom process to support collaboration and spontaneous inquiry, teachers are capitalizing on technology to create excitement and a new positiveness toward learning among their students.

Network technologies appear particularly effective in facilitating the development of child-centered, constructivist learning environments. The skills needed to create such environments are not easily learned. Thus, we will have to be innovative about

how we nurture and encourage teachers and schools to adopt styles that are really quite foreign to them. The current panacea is extensive teacher training. We argue that schools need to become teacher-centered, to build constructivist environments for their teachers that encourage exploration, experimentation, and pedagogical innovation.

In our PCs for Families program (http://pixel.cs.vt.edu/edu/fis/) we are working on such a dually constructivist classroom. We describe the design issues, the cost, and our experience to date with our technology-rich home-school environment.

Introduction

In the fall of 1996, the Computer Science Department at Virginia Tech initiated a joint project with the Montgomery County Public Schools in Virginia to determine how ready access to networked computing in the fifth grade would affect long-term student achievement. With the support of the U.S. Department of Education, we are interested in learning what can be achieved if technology access, support, and curriculum integration can be eliminated as obstacles or constraints in the classroom and at home. To do this we designed a high-tech classroom at Riner Elementary School in which the technology is as ubiquitous as the furniture. We send a computer home with each child and teacher and provide as much support as necessary to all program participants, including parents. Ours is the educational equivalent of the Homenet project at Carnegie Mellon University (Kraut et al., 1997) which studies the effects of giving technology and support freely to ordinary Pittsburgh citizens. After a year of immersive exposure to a technology-rich classroom, our children continue in a conventional sixth-grade classroom but keep their computers at home. We will track our students for several years to determine the effects of their experience on their achievement and on their qualitative success in defining and achieving personal and educational objectives.

In this paper, we focus on issues related to the dually constructivist learning environment created for the project. We believe that in such a learning environment, long-term increases in educational efficacy will be fostered and sustained.

Project Impetus

Network technology is increasingly being incorporated into classrooms across the country and is hoped to increase educational efficacy and long-term achievement gains on the part of the students. However, this influx of technology has fueled a national debate as to the real benefits of the resulting educational transformation. Schools deploy network technology using resource-limited models and seldom have the means to fully evaluate the impact of the technology on the students (Shaw et al., 1997).

Another issue in the national debate over the effectiveness of the current technology thrust in the schools concerns the ability of teachers to leverage the potential that computers may offer to enhance classroom learning. Not only is the technology new to many teachers, but many may have difficulty integrating it into their lessons. Cuban (1986) and Tyack and Cuban (1996) have placed much of the blame for the failure of earlier technologies on "top-down" deployment in which teachers have not been significant participants in the planning and integration process. Unrealistic conditions of access, support, and basic utility, coupled with lack of appreciation for the culture of the classroom and the stringent demands on the teacher, prevented many technologies from becoming significant vehicles for educational reform.

Further, relatively few teachers have mastered constructivist pedagogy, which appears to be one of the principal learning styles supported by computer technology. The degree of success achieved by the computerization of schools may well depend on the ability of teachers to shift to this new pedagogy (Shaw et al., 1997). However, as with the technology, teachers are often being asked to accomplish this transformation without the benefit of sufficient training or other support mechanisms.

The PCs for Families project has attempted to address these issues by (1) eliminating resource constraints commonly associated with the growth of classroom technology, (2) actively involving teachers in the deployment process, (3) providing the teacher with ongoing support for integrating network technology into the educational process, (4) partnering the teacher with a master constructivist teacher during the early stages of the project, and (5) having researchers take responsibility for evaluating the impact of this educational transformation. We set out to determine if under the best of circumstances ubiquitous access to network technology results in long-term achievement gains under the assumption that if such a resource-rich approach did not result in measurable improvements, resource-limited models were unlikely to be successful.

Project Approach

In the PCs for Families project, we took the view that we needed to design a constructivist learning environment for our teacher and nurture her as she nurtured her own charges, thus allowing her to realize fully the potential of the new technology. A major redesign of the physical classroom as well as the educational protocol was required to accomplish this goal. To do that required technical, educational, and administrative support, which was to be provided by three principal investigators who represented broadly diverse areas of expertise in technology, education, and administration. One was a computer scientist, another was a master constructivist teacher, and the third was the school principal at Riner. Time was a major constraint because the new learning environment needed to be online and functional within two months of project initiation.

We were not interested in a laboratory classroom model. From the outset, our goal was to change our fifth-grade classroom into the best constructivist learning environment we could reasonably provide. We reasoned that because spontaneity is such a basic characteristic of a constructivist classroom, we needed an environment that would support not only intentional learning but also the joy of spontaneous discovery. A child wrapped up in discovery is infectious, and it was important to us to design a classroom that would encourage collaboration and the propagation of excitement within the class. We also wanted to capitalize on the immediate availability of information so that the instant a question was posed, the children would be busy searching for answers. Therefore, computers always had to be within reach and ready for use throughout the school day. At the same time, we didn't want the technology to be obtrusive.

Working With the Teacher

The physical classroom was designed by the teacher, technology specialist, and staff members working together in a process known as *participatory design* (Gronbaek et al., 1993). The goal of participatory design is to produce a superior design by teaming interdisciplinary specialists with the domain expert, who is the teacher. First, typical classroom scenarios are constructed and then alternative designs are conceived and evaluated against the scenarios. Together, team members constructed these scenarios, considering where the children would be focusing attention, how they would be collaborating, and what resources they would be using. They considered lighting, visibility, sound, working spaces, and accessibility using drawings with paper cutouts to produce designs they could evaluate. They selected the furniture, color scheme, placement, storage, flooring, and wiring. Even issues such as static electricity, chair rollers, and workplace ergonomics were considered. As the year progressed, adjustments were made as necessary, and special furniture was also designed to support new needs that arose, such as a teacher demonstration station.

While equipment was arriving, we focused on the changes in teaching style that our teacher had to master. Most school technology programs are based upon inservice training; because of the many problems with this model, we decided instead to adopt an apprenticeship model in which a technology specialist would work in partnership with the teacher to provide support and ideas without dominating the teacher or altering her basic role as educator. We have avoided forcing technological details on our teacher so that she could focus on conducting her class. Our method has been to bring the potential of various technologies to the attention of the teacher, sometimes proposing small experiments but without requiring technology adoption. We provide the teacher and her technology partner with computers and free networking at home, and we provide a software budget and a base of installed programs with which they are free to experiment without obligation.

Our classroom teacher, Susan (we use the real names of project staff but fictitious student names), was among the 13 key teachers who participated in discussions and pilot activities during the NIE project. Susan is an experienced professional, reserved, dedicated, and intrigued by the possibilities offered by technology-supported education. Until joining our program she specialized in the fifth-grade Comprehensive School Math Program at Riner. Like a number of her contemporaries she had been trained to use e-mail from her DOS-based PC at school through dialup connections to VaPen, Virginia's public education network. By the time the PCF project started, she had a Macintosh 6100 in her classroom, connected by a T1 connection. Her classroom itself is located in a 25' x 35' trailer that supports 24 students, one of several in use because of a serious space shortage at Riner. Thus, the project began in a rather unremarkable setting that might be typical of educational settings across the country.

Like most teachers, Susan is obligated to cover state-mandated curricula (called in Virginia, the Standards of Learning), plus local additions such as Drug Abuse Resistance Education. Therefore we decided that we would not teach technology during regular class time except when it is essential or related to state mandates. Instead, we have met with the children after school one hour per week. That has reduced the stress on regular class time, and it provides a time when we can experiment more freely with teaching techniques and technologies. It is important to note, however, that responsibility for the after-school sessions is not heaped on our classroom teacher. This program is carried out by the technology specialist.

One of the problems often faced by a teacher attempting to pioneer major classroom changes is the lack of a peer group and the lack of time or opportunity for discussions with colleagues. It therefore fell to Melissa, one of our investigators, a master teacher, to act as mentor and collaborator on educational issues during the first few months when the most dramatic changes in teaching style were taking place. Melissa would present at least one lesson a week to show how computers could be woven naturally into lessons and subsequent student work. Thanks to Melissa's examples, Susan made dramatic progress and mastered the new techniques within an exceptionally short period of time.

Once our design was in place, we continued to learn as we went along. For example, it was soon obvious that the student pairing at the computers was volatile. Partnerships would just wear out and would have to be changed. That created logistical problems associated with moving a student's files from one computer to another. The hardest problem at first was that of moving mail accounts from one computer to another. Such things are technology-induced problems that have nothing to do with the instructional process but add considerable burden to the teacher's load without contributing to educational activity. So we built our support system to address and resolve these problems for the teacher.

It is extremely frustrating to a teacher to design a lesson that relies on technology, only to have a major failure a few minutes before show time. Since a technology specialist is always available, we were able to decrease the frequency of problems and have someone on hand to resolve them while the teacher manages the class. It is also the case that in a truly constructivist classroom there is always uncertainty about what will happen next. The technology specialist is the key to fast turnaround, help in class, and assistance with unplanned adventures.

Many teachers are wary of making extensive classroom use of electronic mail. On technological grounds alone, managing mail accounts can be sufficiently frustrating and time consuming that teachers might well be discouraged from its use. In our case, we felt strongly that teaching our children communication skills and building an ethical foundation was extremely important. Also, we wished to learn more about the use of such capabilities for building a community, not only among our students, but within and among our participating families. Therefore, we are making every effort to support electronic mail and strongly encourage its use. In the process we are able to teach our children things that are grossly misunderstood even in the adult world, such as the unreliability, awkwardness, and security dangers associated with e-mail attachments.

The result of e-mail use is an astonishing increase in the teacher's workload due to the flood of mail that occurs. And this is good. The children learn quickly. They think, they organize, and they write, but teachers find that criticizing electronic homework submissions is very time-consuming work that cannot be done at odd times on the porch or in front of the TV set but only in front of the computer screen. Only the rare teacher will deal with the extra burden this imposes on his or her life.

We attempt to reduce this burden by providing all the technical support, and the technology specialist spends many hours a week as a prime communicator.

Thus, we have worked hard to ensure that the teacher would maintain control over curriculum and classroom protocol and not become discouraged or diverted by technological issues that have no direct bearing on her job. We have found administrative support critical to this process. When a teacher is in the process of rethinking a pedagogical style that has evolved over 20 or 25 years, encouragement, enthusiasm, and unqualified support are essential. The principal must be the cheerleader and the contact person for all of the many physical and logistical needs required to maintain a technically functional classroom. In our case, the teacher was especially aware of affairs and stresses within our participating families. From her vantage point, the relationship between a child's performance and family performance becomes magnified. It is important to the teacher that a strong and committed principal is prepared to intervene directly with the families in cases where a child's performance has become at risk. The principal must deal unequivocally with problems of ethical behavior related to the technology and must stand behind the teacher in the enforcement of student performance standards and classroom behavior.

What Actually Happened

When our project began, our very first concern was to make the right decisions about the classroom design. Giving the classroom teacher design authority is an excellent first step toward giving the teacher a sense of ownership and control. Besides that, an experienced teacher will have excellent intuition about what will work and what won't. The classroom went online in seven weeks, and the basic design has endured. Computers were delivered to the families three weeks later, and by Christmas, Susan had gained much confidence in her new teaching style.

In a classroom this small, the students are always near their computers, and it was difficult at first for the students to leave them alone when their teacher would try to address them as a group. Susan experimented with various techniques for decoupling the students from their computers and would have preferred a master "freeze" button at her desk. The second year, tables were clustered more tightly to make room for a small technology-free group space.

Among our goals was the desire not to teach technology by itself but rather to introduce it naturally in support of genuine pedagogical needs. Moreover, we decided to introduce the children to an adult environment and to try to teach them deeper ideas about information and ethics. Technology introduction was staged according to the needs of the teacher. The World Wide Web was introduced almost immediately since it was to be a basic information source. Next came word processing, then e-mail, then image processing. Along the way the students began to make their own discoveries and taught themselves about such things as sound processing and PowerPoint. In fact, the students discovered PowerPoint before the teacher, which impressed her so much she went home and taught herself. This resulted in a major class production on the story of the Titanic, ending with a formal presentation. Finally, near the end of the school year came FTP and World Wide Web publishing.

As for the deeper issues, the World Wide Web is a natural means for introducing global awareness to our students, who entered with a very local perspective of the world. Much time was spent discussing the credibility of information that one finds on the networks and what one might do to increase one's confidence in information by seeking consistent sources. Ethics were taught over and over again by each staff person, and an entire parent meeting was devoted to the subject so that the parents could reinforce what was taught at school. Whether or not our children choose to abide by the ethical groundwork we laid for them, each has the foundation and each understands how to make good decisions.

Things We've Learned

Technology, like books, blackboards, and crayons, are tools used by the creative teacher to build a learning environment. Network technology adds a new dimension to the classroom and raises new challenges for both teachers and learners. We have found that teachers and learners benefit from learning environments that nurture and encourage them to explore. Now in our second year, it is too early to say what the long-term impact of our dually constructivist learning environment will be. We continue to be surprised by the many different and unexpected events that occur and are constantly struggling to find explanations. Until the long-term achievement data becomes available, we must look at what happens to the children and teachers as individuals to assess the impact of our technology-rich, constructivist classroom. At this stage, our best metric is often whether or not the worlds of project participants have become larger or smaller.

At the beginning of the first year of this project, Susan's room was like any other classroom in Riner. The children had typical desks, reference resources, notebooks, and pencils. The students themselves were typical fifth graders, except that they entered our class by lottery. Much of that changed with the advent of the computers and classroom setup almost two months into the school year. In particular, we would like to relate the stories of two pairs among a number of our first-year students whose lives have changed.

The first pair, Mike and Tom (fictitious names), were about as opposite as two children could be. Mike was on the heavy side, played the class clown, and always put himself down intellectually and physically. Tom was very lean and very quiet, to the point of rarely talking to the other students, even at recess. For no particular reason, they were paired at a computer almost from the start. Initially Mike dominated the computer so completely that we were concerned that Tom was not participating or learning. Over time, they began to work together, not in the way we expected to see, but in the way it worked for them. Mike still controlled the keyboard and mouse most of the time, but Tom controlled the action by pointing and discussing the next action they would take. This cooperation and collaboration spilled over not only into their intellectual pursuits but into emotional and self-esteem issues, too.

Mike became the computer expert. The class clown with his low-self esteem was being replaced by the class problem solver with his computer expertise. He became the student others would ask for advice. Tom began to talk and interact with the class a little more, but more importantly, he found an outlet for the words he was so timid to speak aloud. He found the word processor. He wrote, and he wrote, and he wrote. Mike and Tom became good friends and better students through their experiences and collaboration in the classroom.

The second pair of students were Angie and Karen. These two were very similar in family background and educational level. Both lived in trailers in very rural settings. Neither had ever thought about or believed they could attend college, nor did they sense any particular use for school or education in general. They were very quiet and, to a large degree, loners. They seemed to get along and were therefore paired together at a computer. Again, during the course of the year, they blossomed at many levels. As their computer skills increased they began to work diligently not only to complete their assignments but to complete them on a higher level then they had ever strived for. Angie, in particular, was incredible. Her curiosity was insatiable, and her questions endless. Almost a month before we started Web pages and HTML, she e-mailed the technology specialist asking her to look at the home page she had created on the Internet. Angie was on the computer at home so much that the family finally stretched their budget enough to install a second phone line. Both Angie and Karen are now involved in their own educations; they are asking questions, looking to the future, and doing their best in school.

Not all children enjoy working with computers, of course, but even those who don't seem to have achieved some level of competence. Most of our students, who are now in sixth grade, continue to check their mail and use the World Wide Web. However, several of our children have completely dropped their use of networking, while others who were headed for academic failure have become so engaged that their perspectives and goals have completely changed. Overall, we found tardiness decreased significantly from fourth grade, and we look for this trend to continue as the students move onto sixth grade. Our students now perceive college as an important part of their future, with students rating the importance of college on average at 5.9 out of 6. They enjoy school and rank their enjoyment at 5.0 on a scale 0–6. Of the 16 children surveyed, 13 said they would consult the Internet if they needed to know what is playing at the local movie theater or the number of Virginia representatives in Congress.

Interestingly, both children and teachers perceived substantially less effort by the parents in support of the program than did the parents themselves, with support declining as the year progressed. Possible clues about our observations come from Smrekar's (1996) excellent ethnographic studies of three types of schools (parochial, magnet, and public) which reveal vastly different degrees of parental commitment across the different schools with participation often related to the degree of commitment required by the school. In our project, computers were given to families who joined our classroom by random selection. There were no financial commitments or academic performance requirements for these parents, and therefore no special reason for them to feel a sense of ownership of the program or to increase their participation in school-related activities.

Teachers who visit our classroom note that our children are articulate and self-confident. Obviously these children also have a reservoir of computer skills that rival or exceed those of their peers. While these will serve them well in their jobs, in their personal lives, and in their social interactions later on, we wait with anticipation to see whether our children will use these skills to their advantage as their academic careers unfold. Not the least among our success stories is a teacher who has become stronger and more effective and who has found new and creative ways to engage her students. She has learned much about herself and her ability to grow. She will continue to excite, to challenge, and to show a larger world to many classes to come.

As for networked computing, it serves well as a focal point for involvement in educational reform. We like computers because they are deterministic; we can estimate the hardware, software, and communications costs. We can also budget to the dollar the cost to install and maintain them. However, like many other things, the benefits we realize will depend upon how we invest our resources. The teachers are those who connect technology to learning, and we've barely begun to think about what it costs to help them do that well.

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Workshop

Cooperative Learning and Technology: Activities and Assessment

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Key Words: cooperative learning, lesson plans

Cooperative learning is one technique that is especially successful when it is applied to technology. In almost all elementary school settings, the number of students exceeds the number of computers. Therefore, it is inevitable that two or more students work together at a computer station. Like academic tasks, computer activities may be highly structured so that outcomes are beneficial to all. Students discuss and complete activities, help one another understand them, and encourage each other to work hard.

There are three basic ways in which we learn:

1. Competitively—I sink, you swim, or I swim and you sink.

2. Individually—I sink or swim alone; you sink or swim alone.

3. Cooperatively—We sink or swim together.

According to research, students with cooperative experiences demonstrate higher achievement, increased retention, greater use of higher level reasoning, increased perspective taking, greater intrinsic motivation, more positive heterogeneous relationships, better attitudes toward school, better attitudes toward teachers, high self-esteem, greater social support, more positive psychological adjustment, more on-task behavior, and greater collaborative skills.

How is cooperative learning different than traditional ways of grouping students? There are five basic elements of cooperative learning:

1. Positive Interdependence. Students must feel that they need each other in order to complete the group's task, that they "sink or swim" together. Some ways to create this feeling are through establishing mutual goals (students must learn the material and make certain that group members also learn the material); joint rewards (when all

group members achieve a certain goal, the team will receive points or a reward); shared materials and information (one paper for each group or each member receives only part of the materials or information needed to complete the task); and assigned roles (such as praiser, reporter, writer, reader, and encourager).

2. Face-to-Face Interaction. Interaction patterns and verbal exchanges that take place among students in carefully structured cooperative groups produce beneficial educational outcomes. Giving and receiving explanations, listening and giving oral summaries, and relating what is learned to previous experiences are all important types of verbal exchange. An "eye to eye" physical arrangement helps facilitate this interaction.

3. Individual Accountability. Cooperative learning groups are not successful until every member has learned the material or has helped with and understood the task. Thus, it is important to frequently stress and assess individual learning so that group members can appropriately support and help each other. One way of structuring individual accountability is by giving each group member an individual assessment. Often the accountability is built into a simple structure.

4. Interpersonal and Small-Group Skills. Students need to be taught the social skills they need to collaborate effectively with others. They also need to be given the opportunities to practice appropriate communication, leadership, trust, decision-making, and conflict-management skills, as well as being provided with the motivation to use these skills in achieving group success.

5. Group Processing. Processing means giving students the opportunity and the procedures to analyze how well their groups are functioning and how well they are using the necessary social skills. Processing helps all group members achieve and maintain effective working relationships among members. It is a time when students develop cognitive skills as they work toward group efficiency. Group feedback, individual feedback, and teacher feedback on how the groups are working help to achieve both maintenance and task skills.

The best types of groups are usually composed of high-, medium-, and low-achieving students. Groups of two or three are best at the beginning; groups of four and five work well when the members are skillful. Groups should be a mixture of cultural groups, sexes, and motivational levels. When assigning students to groups, avoid all of one sex, worst enemies, best friends, same ethnic composition, or similar ability levels. It is best to start with quick ways to integrate group work by reviewing for tests in trios, doing work individually and then deciding on group answers, or discussing questions and turning in one answer sheet.

Virtually any software program can be adapted for use in a cooperative learning lesson, but structuring a cooperative lesson involves several components. The task must be clearly defined—students must understand exactly what it is they are to accomplish; "planned" positive interdependence and individual accountability are essential—each student must know his or her role; criteria for success must be chosen carefully—the students must want to accomplish their tasks. It is best if teachers use a wide variety of rewards. A few examples might be free computer time, extra recess time, papers put up on a bulletin board, a certificate, a bookmark, and so forth. Some teachers use a point system where students accumulate points for cooperative learning activities. The points then build over a period of time to reach a set goal. The reward can then be something to work toward, such as a party or a field trip. Points may be added for positive behavior; bonus points may be earned when all members of a group can show mastery; points are earned permanently—they are never taken away. A visual display, such as a poster board on which the points that have been earned are tallied, needs to be posted in the room as a constant reminder of the progress of the group(s) and of the end goal.

The rewards for teachers and for students using cooperative learning go far beyond increased academic achievement. Most human interaction is cooperative. Without some skill in cooperating effectively, it is difficult to hold a job, maintain a marriage, or be a part of a community, society, or global environment. Cooperation is a way of behaving that doesn't just happen; it doesn't occur by accident or wishing it were there. For cooperation to happen in classrooms at all levels, teachers must carefully plan and structure learning tasks in which students practice cooperative skills, learn from their mistakes and successes, and practice on a regular basis.

Spotlight Session

Girls, Girls, Girls ...

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Key Words: girls, software, technology, computers, Web site, guidelines

> Meet the challenge of increasing girls' interest in and skill with technology. Celebrate girls and their uniqueness. Review Internet sites and current software designed specifically to engage girls.

Abstract

With the rapid expansion of technology in a global economy we face myriad changes and problems. As technology becomes part of the fabric of our society, computer skills will become a more significant factor in the economic deprivation or advancement of large segments of society. The increasing "technologization" of today's job market makes it imperative that young women and girls take an interest in computers early on. Gender issues need to be brought to the surface. We will find the challenge of increasing girls' interest in and skills with computers has serious social and economic consequences if left unaddressed.

Concentration on the indoctrination of females into a "male" world cannot be the answer of the "gender gap." We must celebrate the differences in genders and build on each of their strengths. The preliminary report of a study by Simon Fraser University Education finds that the "culture of isolation" surrounding computers is quite difficult for many girls and suggests trying to change what technology does rather than trying to change females (deCastell, 1997). If the issues mentioned here are not addressed, everyone stands to lose. As it is, one wonders how many ideas that could have been contributed by female talent will never surface to enrich our academic computer science. More broadly, what are the repercussions to our increasingly computer-oriented society, if women, about half the population and professional workforce, are not as prepared in this discipline as are men (Turkle, 1988)? The dilemma is making the commitment to enter the arena of using computers in education, whereby educators, programmers, software developers, and parents are faced with the responsibility of designing and purchasing software that is conducive to engaging girls (Marshall, 1983).

Goal 4 of the National Education Goals states that "by the year 2000, U.S. students will be first in the world in science and mathematics achievement." If the United States is to remain competitive in world markets, the nation must have a technologically competent work force. American democracy cannot flourish in the 21st century without a scientifically literate citizenry. Thus, the achievement and participation of girls from all racial and ethnic groups is a topic of considerable importance to policymakers in business and industry as well as education. Girls, however, are steered away from the very courses required for their productive

participation in the future of America. Girls' participation requires strength in science, mathematics, and technology, the subjects they are still being told are not suitable for them.

The problem that will enable and encourage equitable gender interest in future technological endeavors runs deep and wide. Technology is one of the areas where this country is in a leadership position. It's one of the engines driving growth. If women are not versed in technology, they will be left by the wayside in the next millennium.

This session will discuss gender inequality issues, examine the software attributes that are engaging to girls, address the current quality and content of girl-specific software and Web sites, and provide lists of the quality software and Web sites for girls.

Workshop

The Scott County Teachnology Project: TILTing the Use of Technology in the Classroom

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Key Words: professional development, curriculum integration, project, training, staff, student

This workshop will provide a project description and status report on the Teachnology project.

Project Goals

For the next five years the Scott County Schools' goal for technology is to improve student learning through its use. The Teachnology Project was developed to support principals and school technology coordinators in this effort by training and empowering teams of teachers and students to make it happen.

Team Application

Each team of four teachers and four students applied with a curriculum-based project proposal. Their application asked them to describe their ideal technological classroom and to describe what they would like to learn and be able to do. Each principal paid $250 to each team for their participation.

Orientation

In order to start off on an even keel, the teachers met for a half-day orientation. The goals for this time together included:

- Getting to know the other teams and projects
- Reviewing Kentucky's Core Content Guidelines
- Understanding what lies ahead
- Deciding on which seminar to attend

Cooperative Learning Seminars

To develop a variety of expertise on each team, we offered four day-long topics at four different times and asked each team to send one pair (teacher and student) to each seminar. The topics included:

- Web-based project development
- HTML
- Digital photography and CU-SeeMe
- Scanning and computer graphics

Project Planning

Another half-day was spent by the TILT teams meeting together and learning about the expertise their team now shared. The teams had the option to revise and place their plans in the Teachnology. These plans are the beginning of a database of Teachnology that will continue to be built upon as other projects evolve.

Sample Teachnology Project Links

http://www.scott.k12.ky.us/southern/poetpand/index.html

http://www.scott.k12.ky.us/garth/quilt/index.html

http://www.scott.k12.ky.us/schs/dec97/first2.html

Ongoing Support

Throughout the Teachnology project, our primary communication tool is e-mail. This is what we use to keep in touch with each other across the 12 teams in the nine schools that are participating. E-mail also gives access to help from the project coordinators and from resource people around the world.

A page on the Web directs TILT team members to Web pages of material they may find useful to their projects and to their use of technology in the classroom.

Each TILT team member has had access to classroom support from the project coordinators. The school district assured that equipment and additional training needs were met during the school year.

TILT Team Obligations

TILT teams are required to develop lessons and contribute them to the database, display their projects on their school Web site, present at the Kentucky Education Technology Conference, and to tag another teacher as a Teachnology member for the coming year.

Evaluation

An ongoing evaluation is being conducted by a college professor who teaches preservice teachers and graduate education students about the use of technology in learning. Teachers complete self-evaluations at the start, mid-year, and year's end.

Principals file evaluations during the year.

We thank http://stonesoup.net/ for its continuing work on this project. Its members are specialists in Web site development and technology integration.

Poster Session

World Studies Interdisciplinary Project: Integrating Technology With Social Studies

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Key Words: middle school, technology, social studies, interdisciplinary, projects, Internet

Finding the solution to the problem of how technology can be successfully integrated into curriculum areas is currently a major concern facing teachers, supervisors, and administrators. This session will showcase a successful attempt to combine the elements of the team approach and cooperative learning to better integrate technology with the social studies curriculum.

The project involves students working in cooperative groups to create a country-based travel brochure. Each student group has a layout editor, a research team, and a compiler. The brochure must contain the following criteria: country flag, map, climate, attractions, food, currency exchange rate, lodging, and activities information. This information for the brochure is gathered via the use of a CD-ROM multimedia encyclopedia, *MacGlobe*, the ClickBook program, and access to Internet Web sites.

As students prepare for a virtual trip to their selected country, they learn the importance of a passport and create one using a word-processing program and a digital camera. The passport is then used to enter and learn about other countries. To visit a country, students show their passports, which are validated as they enter the Web site for that particular country. In addition, students participate in a keypal exchange with a student from a foreign country. This enables the students to receive first-hand information on their selected country from other students.

This poster session will provide hand-outs with information on software, Web sites used, and "how-to" directions for replicating the travel brochures and passports.

Internet Poster Session

ProjectBIO: College Science Instruction Via the Internet

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Key Words: Web instruction, distance education, college, science, anatomy and physiology

This Internet poster session will provide a hands-on look at the work currently being produced at Iowa State University in Internet instruction. A program has been developed that allows for the teaching of general science courses completely via the Internet. The title of this program is Project BIO, and the URL created for this work is http://project.bio.iastate.edu/.

My portion of this site includes the offering of Zoology 155, Introductory Human Anatomy and Physiology. This course has been available for students since fall semester 1997. The Internet class is divided into "lectures" that correspond to the traditional lectures given on campus. There are visuals incorporated into these electronic lectures, and a digitized recording of the instructor's voice presenting the material. Additionally included are video clips of student demonstrations used in the teaching of the traditional lecture. The purpose in setting this class up over the Internet was to provide as similar an experience as possible to the traditionally taught lectures on campus. It is intended to provide the class experience to those students unable to attend the lectures due to lifestyle or distance constraints.

ClassNet, a Web-based classroom management program created at ISU, has been used in conjunction with the electronic lectures created for Project BIO. This program has allowed the creation of homework assignments and exams that can be taken over the Internet. It grades those assignments and provides immediate feedback to the students in the form of their score and the correct answers to the questions. Another important feature of this program is its communication capabilities. ClassNet provides a discussion forum, a chat session "room," and easy access to the e-mail addresses of all the students enrolled in the class. These features are useful in Internet teaching because class announcements can be made using ClassNet communication and the students can exchange ideas, frustrations, and social comments just as they do during the first few minutes of any traditional class.

There have been more than 2,000 "hits" on the home page to this class since November 1997. While the majority of these are undoubtedly students enrolled in the class, there has been interest in the course outside ISU. Requests from high school teachers for the password to provide their students with information for reports, e-mail from "Web browsers" asking for more information, and requests from other university instructors for help in setting up similar sites are common. This poster will provide answers to these questions by letting interested educators see what the lectures entail and read about and discuss with me the process by which they were created.

Poster Session

Co-Learners: Creating a New Paradigm for Staff Development

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Key Words: staff development, professional development, Lego, science, math, constructivism

The question of how to provide effective and lasting professional development to teachers has plagued every school district. A model that changes the paradigm of how teachers and students learn math and science concepts was implemented as part of a Toyota USA Foundations grant for staff development. A partnership of teachers with very little experience in the use of Legos and of students with much experience in using Legos provided an "even playing field" for the development of a student-centered math and science curriculum. The Lego Logo programming software and Lego kits proved to be an outstanding medium for teachers and students as co-learners.

The Toyota Science and Mathematics Robotics Summer Workshop was developed to accomplish two goals:

1. To provide teachers with professional development in the use of scientific probeware, robotics, and data collection strategies through the use of Lego kits and materials in order to develop lesson plans that integrate technology into the everyday math and science curriculum.

2. To investigate the effectiveness of using student and teachers as co-learners as a component of professional development and to model and promote constructivist teaching practices in mathematics and science among inservice teachers.

Teachers in Grades 4–8 were asked to attend in pairs from their schools for a week-long workshop. Past experience in staff development has shown that support from a fellow teacher encourages problem solving when a teacher returns to school to implement lessons learned. Each teacher was provided with Lego kits, including materials for the development of lessons involving simple machines, scientific probeware, data collection, graphing, robotics, computer programming, and mathematical problem solving.

Teachers were given a short introductory lesson and a problem to solve each day. At the end of a specified time, the teams gathered and discussed each team's solution to the problem. At the end of the week, teachers demonstrated their inventions to the group and discussed the "inventor's prospective" in designing a new invention and carrying the design to success.

The workshop also provided an opportunity for teachers to experience constructivist teaching principles from two perspectives:

> 1. Teachers as Learners. To provide the learner's point of view, the workshop instructors modeled constructivist strategies by establishing a hands-on, student-centered, collaborative environment in which the participating teachers investigated for themselves the math and science concepts they would eventually be teaching.
>
> 2. Teachers as Teachers. To provide the teacher's point of view, children in Grades 4–8 joined the teachers to provide teachers with an opportunity to observe how planned activities might take place in their own classrooms.

Three methods of evaluation were used in the workshops: journal writing, team debriefing, and formal class evaluations used by Ohio University.

General Session: Curriculum Design/Strategies

Exit Exhibitions: How to Drive Technology With Benchmarks

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Key Words: benchmarks, accountability, authentic assessment, culminating activity, cross-curricular, community

It's fine to say we've got technology infused into the curriculum, but how do we know that its implementation is effective? Where and when do students learn how to use various technological skills? In a "design downward" process, benchmarking technology competencies and evaluating them through authentic assessment assures students the skills needed to successfully complete their senior exit exhibition. Without benchmarks, there is no curricular accountability for attaining these proficiencies. But why only an "exit" exhibition? In addition to describing this senior project, this session will also show how the entire process of "paper, project, and presentation" can be implemented on the eighth- and ninth-grade levels. Attendees participate in the structuring of assessment-to-outcomes-to-benchmarks, and will be able to spearhead competency and accountability benchmarks in their own districts.

Poster Session

Engaged Learning Using Technology

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Key Words: engaged learning, NCREL, instructional design, multimedia, biology

The 1990s and the new century demand new ways of learning. The North Central Regional Educational Laboratory (NCREL) model "Learning With Technology" is a vision of learning supported by sound instructional design that produces engaged learning. Engaged learning is a shift from the traditional learning to one where students are primarily responsible for their own learning. It is in this type of environment where technology must lend support to enhance the learning.

The concept of engaged learning is at the heart of the NCREL model. Students and teachers assume various roles and exhibit certain indicators that trigger engaged learning. Students assume roles of teachers, explorers, producers of knowledge, and managers of their own learning. Indicators exhibited by teachers are facilitators, co-learners, guides, designers of curriculum, collaborators with other teachers, and managers. Learning tasks are authentic or connected to the real world to make the learning relevant, challenging, and multidisciplinary. The process and the product are evaluated by students, who specify the assessment criteria.

Learners become involved in the following categories of learning actions in achieving engaged learning: building knowledge and skills; learning independently and with others; demonstrating knowledge, ability, and creativity; and managing learning.

At Kaimuki High School the library media specialists collaborated with a biology teacher on her unit comparing organisms of the five kingdoms through the study of their body systems. The media specialists supported the project by providing guidance and coaching in information literacy skills. Using a Web site on the Internet, students were taught Boolean logic in accessing information. The media specialists suggested appropriate resources, both print and electronic tools, and provided guidance on how to seek information that would prove useful.

Students and teachers held a debriefing. Debriefing as an instructional strategy was a time for learners to reflect on what aspects of the research was difficult and how others assisted them with their learning. With the ClarisWorks word-processing program, the students subsequently produced fact sheets based on the information they had gathered in the library. The library media specialist also presented a lesson on formatting a bibliography and discussed its importance. Meanwhile, the library media specialist was a co-learner in the computer lab as she observed students scanning pictures for their fact sheets and using various features of the ClarisWorks program.

A library work/study student taught the class how to use HyperStudio, a multimedia program. Much discussion and team planning ensued for all groups before and during the creation of their HyperStudio projects using the same researched information. The multimedia projects were shared as part of their oral presentations to demonstrate the new knowledge they had gained and to display their creativity.

The characteristics that made this unit successful were seeing students direct their own learning by tapping each other's skills, making decisions based on consensus, assessing their progress weekly, making connections to prior learning, being risk takers, and showing motivation and enthusiasm for their new discoveries and accomplishments.

Workshop

Tapping Into Online Teacher Professional Development

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Key Words: Internet, teacher professional development, online community, staff development, technology, World Wide Web, curriculum resources

Be a TAPPED IN Teacher

Would you like to expand your network of colleagues, engage in professional development activities online, and be on the forefront of Internet technology for educators? In this workshop, we will introduce you to a new online teacher professional development (TPD) community. The community consists of teachers, staff developers, and other education professionals engaged in a wide range of activities in the Teacher Professional Development Institute (TAPPED IN). TAPPED IN is a *cyberplace* on the Internet that requires no special equipment (just a computer with Internet access), no expensive software, and no membership fees. TAPPED IN is free to teachers, educators, and administrators.

What Can I Do in TAPPED IN?

You can interact directly in real time with other teachers who are TAPPED IN members and participate in community-wide discussions of topics that interest you (on topics relating to curriculum development, assessment, support from your administration, and building a community of learners). TAPPED IN can also introduce you to new resources. TAPPED IN has partnerships with education organizations (e.g., Lawrence Hall of Science, Wiesenthal Museum of Tolerance, Geological Society of America, Swarthmore College Math Forum, and ED's Oasis) and is involved in many local education reform projects around the country. Teachers log into TAPPED IN to discuss issues, create and share resources, hold seminars, and take seminars.

TAPPED IN is patterned after a real-world conference center. Almost everything you find in a conference center in the "real world" is available to you in the online TAPPED IN center (e.g., whiteboards, notepads, tape recorders). This allows you to collaborate with someone who is not in the same physical location as you. Because TAPPED IN uses multi-user virtual environment (MUVE) technology, you can do things in TAPPED IN that are not possible with other Internet technologies. We differ from chatrooms in that you can create, edit, and jointly view documents and even Web browse with someone in a different physical location. We differ from listservs and newsgroups because you can interact in real-time with colleagues. We differ from Web sites in that you can add your own resources, instead of just reading what others have posted or relying on a Web master to post for you. You can also leave comments for other teachers to read later. (Your comments can be there even when you are not.)

In this workshop you will learn how others are using TAPPED IN and how to use TAPPED IN to get the most out of it. You will receive membership, a TAPPED IN T-shirt, help guides, and software. In addition to the workshop training, you will receive ongoing support from TAPPED IN staff after the workshop (to ensure you can "tap in" at home or school). In joining us in TAPPED IN, you will be networked with more than 900 other teachers already TAPPED IN, and supported by many TPD organizations devoted to the community of TAPPED IN. For more information, see our Web site, http://www.tappedin.org or contact Judi Fusco at fusco@tappedin.sri.com.

Workshop

Using Technology to Open Your Classroom to the World

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Key Words: collaboration, projects, curriculum design

> Learn how to design a collaborative project by starting at the grassroots level. Choose simple technology applications or create global projects utilizing state-of-the-art equipment. Successfully using technology to motivate students, engage their imagination, and improve achievement is not so much the product of whiz-bang technology as it is a combination of good curriculum design, collaboration, planning, and follow through.
>
> This session will focus on the development of collaborative projects using technology as a tool to solve a variety of problems. These projects put students in the role of creators of information and publishers for other students, teachers, and the community. A panel of experts will share the elements of successful programs as models of collaboration. Panel topics and members include:

1. Designing, supporting, and evaluating collaborative projects—an overview. Rebecca Goehl, Technology Specialist, San Diego Juvenile Court and Community Schools; Bill Simpson, Technology Coordinator, San Diego County Office of Education

2. CyberFair, a global contest, is a school-based learning project for all grade levels (K–12). Students do research about their local communities in one of eight different categories and then publish their findings on the World Wide Web. Schools participate in a peer review, using a Web-based evaluation rubric. Yvonne Andres, President and Curriculum Director, Global SchoolHouse.

3. The Teams Distance Learning Project was the catalyst for a fourth-grade class that developed its own school-wide trash recycling program. Students used video, faxes, phones, and the Internet to learn how to design their program and then used computers to put together publications to inform their fellow students of the process. By involving the community and even the mayor, this class was recognized across the state for its initiative. Erin English, Educational Technology Teacher, Escondido Union School District.

4. Parent involvement is essential to student success. In this pregnant and parenting teen program, family involvement was increased by including parents in a family tree project using multimedia. By tying into family traditions and pride, teens were able to receive the support they needed, and the parents' awareness of educational opportunities was increased. Joy Benites, Teacher, San Diego Juvenile Court and Community Schools.

As a participant you will focus in on a problem or issue you can address, create an outline for a collaborative project, and identify resources in your school, district, or community. Come participate in a workshop with teachers, curriculum experts, and technology coordinators who will share their secrets for project design and implementation. You will leave the workshop with project outlines, connections to project leaders, and a list of new ideas for projects of your own.

General Session: Laptops

eMate Fever!

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Key Words: eMate, keyboarding, laptop, elementary, word processing, portable, curriculum integration

eMate Fever!

Technology access for each student is a goal; we are piloting 24 eMates. The popularity means that teachers reserve the eMates weeks in advance! Our school has eMate fever; does yours?

St. Mary's purchased 24 eMates for our third- and fourth-grade students to use. Each classroom has approximately 20 students. During the summer, our third- and fourth-grade teachers came to school voluntarily to learn how to use these unique devices. The training workshop included a discussion of how to utilize the 24 systems with 120 students, how to integrate the use of the technology to fit within the classroom curriculum, and how to set appropriate student goals for using the eMates.

Faculty and Students

Our objectives were to provide regular access to word processing and desktop publishing, increased opportunities for keyboarding practice to improve skills using UltraKey by Bytes of Learning, and increased confidence and independence developing proficiency with technology. One result of using the eMates has been increased student motivation and enthusiasm for keyboarding practice and other writing assignments. Infrared beaming between eMates has stimulated collaborative classroom projects.

The use of these systems has created a technological evolution in our school. The teachers have become more innovative in using this technology as a daily tool and have found that it has actually given them time for more activities. Having the eMates in the classrooms has empowered the teachers. It has also reduced the amount of time used for keyboarding instruction in the computer lab by transferring the responsibility of keyboarding instruction from the lab setting to the classroom.

Students have developed a real sense of ownership and pride by reaching higher keyboarding proficiency.

Future Plan

Implementation of the use of the eMate clearly goes further. Using the eMate with the Internet is possible, probeware is available, and other applications such as, spreadsheets, can be utilized where developmentally appropriate.

We would like to share our training, tell our story, and describe our educational vision utilizing such convenient, affordable technology!

Poster Session

Grandparents, Attic: Linking Learning to Life

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Key Words: World Wide Web, history, exploratory environment, elementary, middle school

A popular notion guiding many reform efforts suggests that students at all levels should have the opportunity to emulate the professionals who are practitioners of the disciplines the students are learning. We would suggest that history is a curriculum area in great need of this kind of opportunity. What students learn about history is highly factual in nature, and often these facts are learned in a disjointed fashion. Students miss out on the primary focus of historians—explanations for why and how historical events transpired (McKeown & Beck, 1990).

We have focused our work on the courses in which students study the history of their state. In our location, this content is considered in the fourth and eighth grades. Our intention was to create a learning environment that would be familiar and authentic from the perspective of younger students and would allow the study of a greater variety of historical artifacts. The hypermedia environment we created was called Grandparentsâ Attic. Different attics were created to provide information about groups of particular importance in the time period 1880–1920. The attics allowed students to explore by clicking on objects that appeared on the screen. Students moved from area to area by clicking. Many objects gave some type of informative response. Trunks opened to reveal other objects. Some objects revealed a text box containing descriptive information. Objects, such as books, diaries, and photo albums, contained images and text information. Images in the photo album could be turned over to reveal comments on the backs of the pictures. Some text sources could be read to the students in the native language. In a typical task, students were asked to explore an attic in preparation to create a certain type of written product. (For example, assume the role of a tribal elder, and write a letter to your granddaughter explaining the importance of traditions in everyday life.) A preliminary evaluation of this technique demonstrated some benefits to students (Grabe & Tyree, 1997).

We are presently extending this approach with the assistance of a Department of Education Technology Challenge grant using the Web so that the materials will be available throughout the state. We are also attempting to develop what we call open-ended exploratory environments. This concept proposes the development of a structure that students can both explore and contribute to. Our intent is to provide authentic experiences in two ways—(a) the processing of authentic artifacts contained within the virtual environment and (b) the processing of authentic local sources. Students will be invited to contribute items from their communities (digital images from local museums, interviews with elderly from their communities) to designated components of the virtual attic (photo albums, newspapers).

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General Session: Laptops

In Our Laps! Student/Teacher Training at a Laptop School

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Key Words: laptop computer, technology training, gender issues

Forest Ridge School of the Sacred Heart is one of the pioneer schools in the Microsoft sponsored Learning with Laptops program. The program started with the 1996–97 school year. This fall, Forest Ridge enters its third year as an increasingly "laptopped" school. By the 1999–2000 school year, all students and teachers at Forest Ridge will have laptops. Our increasingly "laptopped" status creates some exciting and interesting opportunities, as well as challenges. One of these challenges is the training of students and faculty in the use of the laptop. This training ranges from basic instruction on laptop use for new students and faculty to ongoing support that helps students and faculty discover how to best use laptops in their courses.

Forest Ridge is a rich environment for curriculum experimentation and research. To fully appreciate the impact that this laptop program has had, and will continue to have, at Forest Ridge, it is necessary to know a bit about our school. The high school is small, with approximately 140 students in Grades 9–12. We are an all female school with a college preparatory focus, which gives us the fairly unique opportunity to explore gender specific issues in education. Our faculty is very committed to the institution and its goals, and plays an important role in school policy and decision making. Finally, and perhaps most importantly, we have a relatively bureaucratically unencumbered school administration and board of trustees whose members are innovative, decisive, and risk takers.

This school year (1998–99) will be our third in the program. Our plan has been to phase in the laptops over a four-year period. In the first year (1996–97), only ninth graders were required to have a laptop, with other students having the option to participate. In the second year (1997–98), every freshman and sophomore was required to have a laptop. This coming school year (1998–99), all students, except seniors, will be required to have a laptop. By the 1999–2000 school year, we will be a completely laptopped school.

The faculty at Forest Ridge has had laptops since the beginning of the program in the summer of 1996. The school provides laptops for all faculty. The school also provides Internet access for each faculty member at school and at home.

The training needs in such an environment are diverse and ongoing. Because the laptop program is so unique and has evolved so rapidly, we necessarily developed student and faculty training, to a great extent, by the "seat of our pants." We have generally discovered that a peer (student and teacher) teaching model of laptop training has worked well for both students and faculty. The talk will share some of these approaches, their evolution, as well as their strengths and limitations. These approaches may be adaptable to other school environments considering a school laptop adventure.

General Session: Curriculum Design/Strategies

Enriching Curriculum Packages With Technology: Help for Technology Specialists

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Key Words: professional development, technology specialists, technology and mathematics integration, electronic graphing/spreadsheets

While training teachers to use hardware and software is a substantial task for technology specialists, an even greater challenge they face is that of supporting teachers to exploit the potential of these tools for specific content areas, to extend and deepen student learning in the heart of classroom life. Still an additional set of demands surface for teachers, and for those who support them, when technologies are introduced into content areas in which school systems have recently adopted curriculum packages. What does it mean to exploit the potential of tools in content areas, for teachers who are grappling with the dual demands of adopted curricula and new technologies? Even when technology has been written into new curriculum it is often poorly articulated: activities for which the tools are recommended only occasionally exploit their real power, and the coordination with the rest of the curriculum is minimal. How is a teacher to identify optimal uses of new tools, while simultaneously making sense of new curricula, both of which often involve new relationships to content and pedagogical processes? Technology specialists can play a key role in helping teachers integrate the powerful pulls of these two innovations, when they find ways to complement and capitalize on the structures that are already in place to support reform with new curriculum packages.

The presenter will use case studies from two elementary schools in Hanau, Germany, to illustrate and highlight the issues that arise when technology tools and adopted curricula come together, and she will draw on these experiences to suggest processes for transforming these constraints into leverage points on which technology specialists can build.

A central feature of our work with the Hanau Model Schools Partnership (a TERC project funded by the National Science Foundation to assist a K–12 complex of four DoDEA schools for dependents of U.S. Department of Defense employees in Hanau, Germany, in meshing the infusion of technology with their efforts toward curriculum reform) has been professional development to support technology integration with curriculum. When examining the elementary mathematics curriculum we found that, without adequate supplementary materials and support, the tools recommended by the DoDEA's adopted curriculum (electronic graphing and spreadsheet tools) had the potential of undercutting some of the very content and processes that the new curricula and approaches were intended to address. Coming from their own experiences as learners in which speed, efficiency, and getting to "the one right answer" too often defined mathematics, teachers tended to view these tools as efficient means of getting their students to produce "correct" answers and graphs as part of a final presentation. Rather than enriching children's understanding of data, used in this manner these tools reduced graphing to a mere set of efficient procedures. The presenter will describe the processes through which elementary teachers from Hanau were prepared and supported to reconceptualize the role of these tools, realigning their use with the goals of the system-wide mathematics program.

The presentation will round out the case study with a broader discussion of ways in which technology specialists can address the competing demands of new technologies and adopted curricula, through work in the following areas:

- choice of productivity tools as part of a common tool kit, supported across the site
- analysis and revision of curriculum materials, programs, and professional development, to incorporate technology tools
- introduction to tools in the context of the content and curricula they are intended to address
- use of samples of student work, both on and off computer, in helping teachers make discerning choices about uses of technology tools
- provision of common planning time
- follow-up support through observations, co-teaching, focus groups, and refresher courses
- work with key players across the system to support, with materials and perspectives, the integration of technology tools and new curriculum initiatives

The literature on technology in education acknowledges the need for ample resources to be devoted to professional development for technology use. But that professional development needs to go far beyond "training" with the goal of tool mastery. When they make a concerted effort to help teachers deepen their understanding of the potential and the limitations of technology tools in the context of specific content areas, to review the role of technology within adopted curricula, and to include involved parties from all levels of the school system in these processes, technology specialists form a key link between technology and school reform. The URL for the Hanau Model Schools Partnership is http://modelschools.terc.edu/.

Paper Session

Computer Literacy Taught Through Student-Centered Activities in Elementary Teacher Education: Constructivist Theory Put Into Practice

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Key Words: computer literacy, teacher education, constructivism

Abstract

The effective use of technology in the classroom has become a focal emphasis in K–12 schools. Because of this emphasis, teacher education programs are expected to provide future teachers with an education that includes teaching specific content areas as well as becoming computer literate. But what is the definition of computer literacy and how does one become computer literate? Are teachers computer literate if they are knowledgeable of computer terminology and can perform basic tasks, such as using a word processor for making out tests or searching the World Wide Web? And most importantly, which comes first, the theory or the practice? Or can the two be taught simultaneously?

During two semesters, pre- and post-questionnaires were administered to 73 preservice teachers completing an integrated elementary method courses in mathematics, science, social studies, and language arts. The pre-questionnaire was designed to assess students' computer skills before entering the senior method courses. Then, each of the 73 teachers were tracked at the end of their first year of teaching to assess how frequently they were using technology as an instructional tool and for what purposes. Only 56 of the 73 preservice teachers were found to have completed one year of teaching. The tracking questionnaire assessed how frequently they had used technology as an instructional tool, and a content analysis summarized how they were using technology as an instructional tool. The results of this study provide valuable information for teacher education programs seeking ways to increase the probability that teachers will transfer computer skills into their classrooms.

Background

Across the nation, teacher education programs have addressed this challenge in various ways and at different rates. The National Council of Teachers of Mathematics (NCTM) Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989) provide guidelines for preparing preservice teachers to teach mathematics so they enter into the classroom with the skills needed to compete in the 21st-century workforce. These guidelines can be applied across the curriculum because focus on exploration, problem solving, reasoning, connections, and communication supports the underlying constructivist philosophy. Curriculum standards in other disciplines emphasize the importance of producing computer literate teachers for the 21st century. The new standards focus on teachers encouraging students to explore and discover information using computer software, such as word processors, spreadsheets, electronic mail, and network browsers. Given this current emphasis for computer integration into precollege classroom instruction, the question arises whether the use of computers as an instructional resource should be taught in a separate course or integrated into the current courses in much the same manner as mathematics is integrated and taught based on the hands-on, exploratory methods supported by the constructivist philosophy.

As we enter the 21st century, educators agree that our future teachers will be faced with the challenge of knowing how to use computers. However, there are different definitions of computer literacy. Researchers have conducted studies to determine university students' degree of computer literacy, and each includes different computer applications as the baseline criteria (Blubaugh, 1988; Fox, Thompson, & Chan, 1996; Furst-Bowe, Boger, Franklin, McIntyre, Polansky, & Schlough, 1996; Russet, 1995; Sheffield, 1996; Thomas, Larson, Clift, & Levin, 1996). Furthermore, researchers have supported the integration of technology across teacher education courses as opposed to an isolated topic (Blubaugh, 1988; Brownell & Brownell, 1991; McEneaney, 1992; Schmidt, Merkley, Strong, & Thompson, 1994; Russett, 1995; Wetzel, 1993) and have found that teachers' attitudes toward computers affect their willingness to use technology in their classroom instruction (Boone & Gabel, 1994; Kluever, Lam, Hoffman, Green, & Swearingen, 1994; Hunt & Bohlin, 1993; McEneaney, 1992; Okinaka, 1992). Niess (1990) went a step further by developing a set of guidelines that can be applicable to all teachers, regardless of grade level or subject matter, for integrating computer-assisted instruction into the curriculum:

- fit the computer to the curriculum rather than the curriculum to the computer
- use the computer as a personal and professional tool
- use the computer in the learning of subject matter

These guidelines are important as teacher training programs are modified to incorporate components for training teachers to use technology. Too often teachers view computers as isolated instructional resources that require more time, above and beyond their normal instructional planning, to integrate as an instructional tool for meeting their current curriculum objectives (Thomas, Larson, Clift, & Levin, 1996; Thompson & Schmidt, 1994). On the contrary, the integration across the curriculum provides preservice teachers an exploratory and discovery environment to become confident in their ability to use different computer applications for instructional purposes. If it is true that preservice teachers will teach as they are taught, it becomes a necessity to determine the most effective way to train preservice teachers to enter into their own classrooms integrating technology appropriately.

Purpose and Objectives

The purpose of this study was to provide preservice teachers the opportunity to use various computer applications for teaching math, science, social studies, and language arts while completing an integrated senior-level block of method courses. Then, determine the transfer rate of technology across the curriculum by those teachers who were taught simultaneously how to use computers as an instructional resource during a block of methods courses. The future teachers were tracked and surveyed after their first year of teaching experience to assess how much of the integrated technology training was still present as part of their teaching and how they were using the resources in the classroom.

To provide a problem-solving environment in the classroom, elementary teachers must feel confident in their ability to use computer applications as tools for solving problems. Thus, the primary focus of this study was to produce preservice teachers who were considered computer literate, which was determined based on their confidence in their ability to use computer applications (e.g., word processor, spreadsheet, e-mail, and the World Wide Web) as instructional tools during their first year of teaching. Research studies have reported that most preservice teachers entering today's teacher education programs are familiar with using a word processor (Fox et al., 1996; Sheffield, 1996) more than any other computer application. However, there has been a need to investigate the most effective approach for integrating computer training into preservice education (Waugh & Rath, 1995). Therefore, the objectives of this study were to expand the current research by (a) assessing elementary preservice teachers' computer skills when they enter into the integrated mathematics methods course, (b) determining if elementary preservice teachers' computer skills improve after completing a technology-integrated mathematics methods course, and (c) tracking the preservice teachers to determine how much of the technology integrated instruction was transferred into the classroom.

Method

During two semesters, pre- and post-questionnaires were administered to the preservice teachers completing an integrated elementary method courses in mathematics, science, social studies, and language arts. These courses were taught as a block of methods courses by four instructors. The pre-questionnaire was designed to assess students' computer skills before entering the senior block. The students were asked to choose from the following computer applications and to check all that they felt comfortable using: word processor, spreadsheet, e-mail, and World Wide Web browsers. This pre-information was used by two of the faculty to develop interdisciplinary instruction and assignments emphasizing the effective use of computer applications as instructional supplements to teach math and science. As part of the course, all students were provided an e-mail account to be used during the semester. At the end of each semester, the students completed a post-questionnaire. They responded how frequently they used the computer applications during the semester and their post-comfort level on using the computer applications in the classroom.

Description of Each Semester's Content

During each semester, the students could use computer applications to complete assignments in all four method courses but were only required to do so during the fall semester. The assignments ranged from using the word processor for lesson plans and spreadsheets for graphing to communicating with peers and completing assignments using e-mail. As an example of an interdisciplinary assignment, an observational experiment and graphing assignment was designed by the math and science instructors. During the fall semester, the 40 students conducted an observational experiment as part of the science methods and graphed the results as part of the mathematics methods. The students were not shown how to use a spreadsheet. If they did not know how to use a spreadsheet, they could pair with a partner or explore individually to learn the basics of a spreadsheet; but the assignment required that they use a spreadsheet to complete the assignment. During the spring semester, the same assignment was given to the 33 students in the method courses. Again, the students were not introduced to spreadsheets, and, in addition, they were not required to use a spreadsheet to complete the assignment. The purpose was to assess if the students would transfer their computer skills and choose to use spreadsheets even though it was not a requirement of the assignment. At the conclusion of each semester, the post-questionnaire assessed how frequently they used technology during the semester and their post-comfort level on using the computer applications in the classroom.

Each of the 73 teachers were tracked at the end of their first year of teaching to assess how frequently they were using technology as an instructional tool and for what purposes. Only 56 of the 73 preservice teachers were found to have completed one year of teaching. The tracking questionnaire assessed how frequently they had used technology as an instructional tool, and a content analysis summarized how they were using technology as an instructional tool.

Results

The students' pre- and post-responses concerning their levels of comfort in using the various computer applications are given in Figure 1. As reported in the research, a majority (76%) of the 73 students reported they were comfortable using a word processor when they entered the semester. However, only 31 (42%) reported they were comfortable using e-mail and only 23 (31%) were comfortable using a World Wide Web browser. After completing the block of method courses, the students were more comfortable using all three computer applications in the classroom.

LORI NOVAK

Figure 1. Students' Reported Ability to Use Computer Applications.

The students' pre- and post-responses for using spreadsheets are given in Figure 2. The purpose for reporting the preservice teachers' use of spreadsheets separately was to compare their pre-and post-responses to their ability to transfer their skills for using spreadsheets for instructional purposes based on whether they were required to use the application to complete an assignment.

Figure 2. Students' Reported Ability to Use Spreadsheets.

During the fall and spring semesters, 18 of the 40 students (45%) and 6 of the 33 students (18%), respectively, reported they were comfortable using a spreadsheet when they entered the block. During the fall semester when the students were required to complete the graphing assignment using the spreadsheet, 78% reported they were comfortable using spreadsheets by the end of the semester while only 45% responded in the same manner after having the option to choose their method of graphing. Of the 33 students during the spring semester, 13 (39%) chose to use the spreadsheet as a graphing tool even though it was not a requirement. The remaining students turned in hand-drawn graphs.

The students were asked how frequently they used the computer applications during the semester. It was not surprising that all of the students reported they used e-mail and word processors often because so much of their work required them to do so. However, the students' responses to their frequency for using spreadsheets supports the results previously reported. During the fall semester when the students were required to use spreadsheets for an assignment, the frequency of use was higher than during the spring when the use of a spreadsheet was optional. The use of a World Wide Web browser was approximately the same during both semesters, and this was expected considering the primary use was to option lesson ideas and plans to use in the classroom.

Table 1. Frequency Preservice Teachers Report Using Computer Applications

Fall	**None**	**Sometimes**	**Often**
word processor	0	3	37
spreadsheet	5	6	29
e-mail	0	0	40
World Wide Web	2	22	16
Spring	**None**	**Sometimes**	**Often**
word processor	0	0	33
spreadsheet	7	18	8
e-mail	0	0	33
World Wide Web	0	25	8

A content analysis was conducted to summarize the preservice teachers' reported uses of the computer applications as an instructional tool. The results suggested that the preservice teachers responded based primarily on what they had experienced during the semester. However, using the specific computer applications for enrichment and remediation were not discussed during the semester. Therefore, these responses reflected the preservice teachers' abilities to transfer their knowledge for using technology in the classroom. The following categories summarized the preservice teachers' responses: instructional tool for students, research tool for students, enrichment/remediation tool; spreadsheets as a gradebook, World Wide Web for lesson planning, and e-mail for communicating with other teachers and students gathering data.

One year later, the teachers from the spring and fall semesters were tracked to determine if they were using technology as an instructional tool in the classroom and for what purposes. Of the 73 preservice teachers, only 56 were found to have completed one year of teaching. The tracking questionnaire asked the teachers if they were using technology in the classroom at least once a week as an instructional tool and to check all of the following computer applications that they had used: word processor, spreadsheet, e-mail, and World Wide Web browser. Of the 56 teachers, 31 (55%) reported they had used technology in the classroom at least once every week during their first year of teaching. Of the 25 reporting they had not used technology in the classroom, 19 reported the barrier was a lack of computers in their school. The remaining six teachers reported time constraints as a barrier. An additional telephone interview indicated that each of the six teachers did have access to computers in their schools. Their responses could have been an indication of the teachers not feeling as confident using the applications, and thus more time would have been required to integrate the technology into their classroom. All six of the teachers were in the spring semester group that were not required to use technology to complete their assignments. A final question was asked to determine how the teachers were using word processors, e-mail, and the World Wide Web in the classroom. The teachers were to list all of the ways that they had used each of the computer applications listed in Table 1. A content analysis was used to summarize their responses. The results are provided in Table 2.

Table 2. Frequency of Technology Use in the Classroom After First Year Teaching

Responses	**Fall Teachers**	**Spring Teachers**
Spreadsheets for student projects	30 (94%)	15 (63%)
Spreadsheets as a gradebook	25 (78%)	11 (46%)
Students using e-mail	27 (84%)	21 (88%)
Teachers using e-mail to communicate with colleagues/other professionals	15 (47%)	12 (50%)
Teacher prepared reports to parents	32 (100%)	18 (75%)
Lesson planning ideas from World Wide Web	31 (97%)	24 (100%)
Student research projects using World Wide Web	32 (100%)	24 (100%)

The tracking data indicated that the teachers entered into their first year of teaching with the confidence and knowledge to incorporate technology as an instructional or professional tool into the classroom. Of the 32 teachers who had completed the method courses during the fall semester when the use of spreadsheets was required for completing assignments, 94% reported using the spreadsheet for students' use, while 78% reported using the spreadsheet as a gradebook. These results were greater than for those teachers who were not required to use a spreadsheet to complete the assignment: 63% and 46%, respectively. This supports the hypothesis that teaching computer literacy simultaneously with the methods courses promotes self-confidence among teachers to transfer their computer skills into the classroom. Further research needs to be done to determine whether this transfer rate is higher when compared to computer literacy being taught as a separate component from the methods courses.

Conclusions

The results of this study indicate that the integration of computer literacy in methods courses does provide future teachers the confidence to transfer their computer skills into their classrooms based on their own exploratory experiences. These results can assist other preservice education programs as modifications to elementary teacher education programs are made for integrating technology into the program such that preservice teachers enter the 21st-century classroom with the positive attitude and confidence needed to teach mathematics in a technological society. By observing the ways teachers reported using the computer as an instructional tool, the data suggest that it was important to integrate the use of computer applications into the already existing preservice methods courses to provide the teachers the opportunity to experience exactly how technology can be integrated into the daily operations of the classroom. Furthermore, the interdisciplinary approach provided the preservice teachers with the much needed emphasis on the importance of teaching math, science, social studies, and language arts concepts as integrated topics.

A note should be made concerning the importance of having an accessible computer laboratory at the university for the preservice teachers to use during their courses. This was a major problem during the fall semester because the preservice teachers found the computer laboratory closed at 5:00 p.m., and it was normally reserved for instructional purposes during the afternoons. For the spring semester, this problem was slightly improved when the computer laboratory extended the hours of operation until 9:00 p.m. and a public computer laboratory in the library was used by the students. However, the preservice teachers still commented that they do not have easy access to the computers during the afternoons. This was an important concern and should be addressed by preservice education programs before the use of computers are incorporated as a major component of the curriculum.

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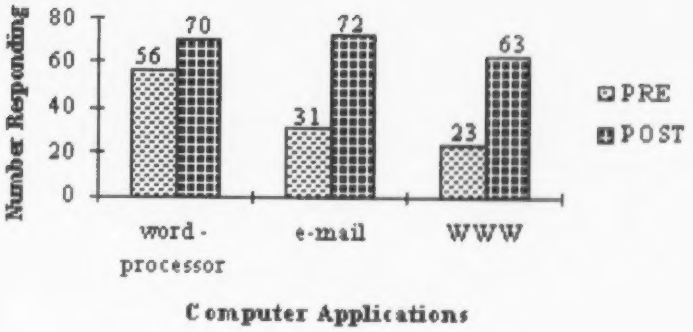
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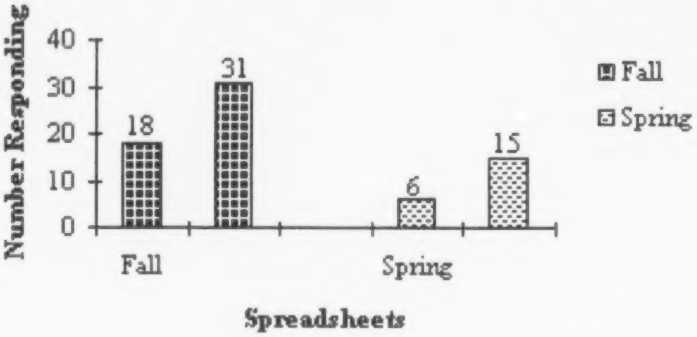
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General Session: Curriculum Design/Strategies

Incorporating Technology in an Integrated Arts Program

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Key Words: arts, music, art, MIDI, animation, middle school

In this session, a music and an art teacher share an innovative middle school arts curriculum aligned with state and national standards that manages the challenges brought about by quickly changing technology, advancements in telecommunications, and the introduction of new standards and assessments of student learning.

As a participating school in Vermont's Web Project, a U.S. Department of Education Innovation Challenge Grant, North Country Union Junior High School (NCUJHS) in Derby, Vermont, has developed a program using multimedia, MIDI composition, and telecommunications to teach concepts in music and art. The school currently has five multimedia computers that are cycled through the art and music classrooms, ensuring maximum usage. The teachers stress common vocabulary, concepts, techniques and skills, and assessments between the disciplines.

In developing this curriculum, key initial questions were addressed:

1. How do we provide a structure that enables students to learn key concepts while allowing for creative expression and individual variations? In creating structured assignments, we began by providing a context for both computer animation and MIDI composition. From there, we allowed for concrete application of the concepts. This lead to structured assignments with specific parameters and guidelines but with allowances for students to go in their own directions creatively.

2. How do we ensure that students use the computers as means of learning arts concepts? The concern that students not "play" on the computers but use them as a tool for learning is one shared by most teachers using technology. We found that the choice of software is crucial to this

question. The programs should be easy to use, but the students should need knowledge and skills to create their artwork. Their work should represent a learning process, not just show what they have learned, that is to say, they should learn the concepts as they work at the computer. Lessons and assignments should be extremely simple at first, and expectations realistic.

3. What are the standards and concepts we will be assessing and how will we measure progress? We draw from the Vermont Framework of Standards and Learning Opportunities, as well as the National Standards for Music and Art. The areas that we emphasize are skill development, reflection and critique, making connections, and approach to work. Students are assessed on skills activities and critique, and their final projects are assessed according to rubrics that they generate as a class.

4. How can we build on commonalities between the visual arts and music? In using technology in both music and art classes, the students use common vocabulary, key concepts, assessments, and reflection and critique.

5. How can we use artists in residence to enhance the learning? At first, we used artists in residence when we were beginning to learn the technology ourselves to help us learn the basics. Later, we found that it is most valuable at the stage of revision of student work, when the artist can bring creative feedback at a higher artistic level than we are able to provide.

All 360 students in the school create original MIDI compositions in both seventh and eighth grade, and these pieces are shared through the Vermont MIDI Distance Learning Network, which currently involves 30 schools. Work is uploaded onto a password-protected Web site, that allows other member schools to download the pieces and critique them. Critique and reflection is vital to the curriculum, with all classes giving feedback and getting ideas from their colleagues online across the state. Student work has been revised as a result of suggestions received from other schools as well as from composers who serve as online mentors.

In their first year at NCUJHS, students create original animations, beginning with a brief overview of film and animation. The students then make flip books, which provides them with a concrete application of basic animation. At this point in the process, students work in groups to plan their animations through the use of story boards. Concepts, such as transition, timing, clarity, communication of story line, and camera angles, are continually stressed as they move to the computers and create their pieces. In eighth grade, the children work with video production, building on previously learned skills and concepts. They are encouraged to communicate ideas and information in more sophisticated ways. Through the use of nonlinear digital video technology, all students are able to learn standard video concepts.

The emphasis of this curriculum is on original student work, using computers as a tool of expression. We have found that student work improves greatly as a result of the teacher learning curve, and lessons should be kept simple as the instructor learns the software and hardware.

Examples of our students' past work, as well as the scope of the Web Project can be seen at www.Webproject.org. The MIDI Distance Learning Network is one of the initiatives with many schools participating, and some of our compositions are displayed on the "public" site at http://www.Webproject.org/mini/. NCUJHS student animations are also displayed in the interactive area of the site.

General Session: Technology Training/Staff Development

A Collaboration of Five Teacher Training Institutions: Preparing Illinois Educators for the 21st-Century Background

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Key Words: teacher education collaboration, technology training

Introduction

> *Teachers and Technology: Making the Connection*, (U.S. Congress, 1995), is making us aware that "technology is not central to the teacher preparation experience in most colleges of education. Consequently, most new teachers graduate from teacher preparation institutions with limited knowledge of the ways technology can be used in their professional practice" (p. 165). Few preservice programs are sending forth teachers prepared to use technology well as an instructional tool in their new classrooms. A critical factor in the school setting is administrative support. Lack of administrative support is most critical because it is linked to other factors that help teachers, such as staff development, resources, and ongoing planning (Ritchie, 1996).

The PIE-21 Project

Five Illinois universities, the National Center for Supercomputing Applications (NCSA), and Illinois Area IV Learning Technology Hub are collaborating in the Preparing Educators for the 21st Century (PIE-21) program. This HECA/ISBE funded project focuses on providing preservice teachers, administrators, and teacher education faculty with the skills and knowledge necessary to effectively use information technology. NCSA participated by coordinating the project during its first year, offering technology workshop opportunities, and providing mechanisms for group communication and electronic collaboration.

Key objectives for PIE-21 include the following:

- develop models for teacher preparation that can be adopted at all colleges of education
- prepare faculty, administrators, teachers, and students to effectively use information technology resources
- establish partnerships within local communities and educational organizations statewide

Project at Eastern Illinois University

The primary objective of the PIE-21 project at Eastern Illinois University is to ensure that student teachers emerge from their college careers with the skill and knowledge to be able to deal with information technology as they enter teaching careers. The PIE-21 project at Eastern Illinois University is meeting with success as the teams continue to work as a collaborative learning community. Many new technology skills have been learned and the teams are anxious for the student teachers to implement the projects and share their skills with the students during their student teaching semester.

Project at Illinois State University

The Illinois State University model is based on the integration of information technology into methods classes at both the Wheeling Professional Development School (PDS) and on campus. The ISTE/NCATE standards are used as technology guidelines for the program. Fall semester students take methods classes delivered on-site and complete a field experience in their assigned classrooms. Spring semester students teach in Wheeling.

Project at National-Louis University

National-Louis University (NLU) has been using the ISTE Foundation Standards as a framework to help us move toward greater integration of technology into our preservice programs. That is an ongoing effort at this institution. It is not, however, these ISTE Foundation Standards or the Elementary Education Program that was the focus of NLU's PIE-21 project during the first year of this collaboration among our five institutions. The focus was the integration of technology experiences into the Educational Leadership Program and identifying the knowledge and skills needed by future principals and superintendents.

Project at Southern Illinois University—Edwardsville

Southern Illinois University—Edwardsville (SIUE) already had a significant program for technology integration and P12-university collaboration before this grant in three areas: an experimental middle school professional development school with an on-site preservice teacher and administrator cohort; a field-based, collaborative on-campus preservice teacher education program; and a rich science education curriculum. However, the grant brought the on-campus participants into close collaboration with technology innovators statewide and, consequent to this, with each other. ISTE Computer Literacy Standards and the new K–12 State Learning Standards were used to critically redesign our curriculum, especially emphasizing hypermedia, applications and Internet tools in a context stressing collaborative learning, problem solving, and portfolio building. This year we have focused on developing the concept of portfolio-based evaluation. Students self-evaluate their progress in technology competency and integration at crucial points during the two-semester methods sequence. The Professional Development School at North Middle School includes development of the curriculum that has been a model of faculty-staff collaboration. For our PIE project, the most significant technology implementation occurred because the ISTE Computer Literacy Standards were used to develop the North curriculum.

Project at College of Education, University of Illinois, Urbana-Champaign

At the College of Education at the University of Illinois, Urbana-Champaign (UIUC), we have investigated two uses of technologies for improving the preparation of precollege teachers. One of the major strengths of the World Wide Web is that it allows a broader set of people to publish their expertise. Student teachers are relative novices—it would be much more useful to publish the expertise of exemplary, experienced practicing teachers. It is difficult for those teachers to find the time to write about their experiences so that others can benefit. Student teachers are given a class assignment to work with their cooperating K–12 teachers to identify a "best practice" that the K–12 teacher has done successfully in his/her classroom and that the teacher is willing to share. The student teacher writes about the "best practice," shows it to the cooperating teacher for corrections and extensions, and together they develop a finished article to be featured on the Web. The Technology Competency Matrix (TCM) was tested with twelve students in an elementary education student teaching program at the University of Illinois. Students were motivated to use the TCM because it provided them with an electronic portfolio demonstrating their technology competency that they could use as part of a job search and show on the Internet. In addition, students printed out relevant Web pages and used them as a print-based portfolio for interviews in schools that did not have easy access to the Web.

Conclusions

There were direct benefits to each of the institutions through PIE-21 experience. The team meetings included exposure to current ideas about technology integration and how they were being implemented in the state, our K–12/university collaboration, and demonstrations of innovations in educational technology being developed at NCSA/UIUC.

Spotlight Session

Generation WHY

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Key Words: student/teacher collaboration, educational reform

Generation WHY is a U.S. Department of Education—funded Technology Innovation Challenge grant. This grant is in its second year of a five-year granting cycle and was awarded to the Olympia School District in Washington state.

To briefly review some of Generation WHY goals: (a) secondary students enrolled in the Generation WHY class learn technology skills to help teachers infuse technology into their curriculum, (b) these students are then paired with one of their teachers to transform a teacher's lesson, hopefully for the better, using technology, and (c) students graduating from this semester class are encouraged to work with all the teachers they come into contact with over the years to provide assistance in helping to improve schools and student learning. In addition, graduates of the Generation WHY class work with colleges of education and elementary schools, and act as lab assistants to keep computer labs open in the evenings and weekends.

Spring semester of 1998 was the third semester that Generation WHY classes were offered. The number of classes began at 6, then 10, and finally 19 classes will complete the course in June of 1998. Fifteen of the classes are in Washington state school districts and the remaining four are located in the U.S. Virgin Islands. Plans for the fall of 1998 are for 58 Generation WHY classes to be offered throughout the United States.

The most important question that Generation WHY continues to find answers to is how can students best be trained and used to partner with educators to reform school for the better (improve student learning). The project is learning how to maximize the success of the student/teacher pairings, the lesson plans, and assessment strategies. A team of subject-area consultants provide feedback to each of the more than 400 projects taking place in the spring 1998 semester. What type of feedback and in what form is most beneficial to project success? A more detailed overview of the model and preliminary answers to these questions will be given in this NECC '98 Spotlight Session. Generation WHY information can also be found at http://kids.osd.wednet.edu/ on the World Wide Web.

Spotlight Session

Wetware: Design Tools for Curriculum-Based Telecomputing Projects

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Key Words: telecomputing, curriculum, activity structures, design, Internet

Most of our Internet-related professional development to date has been about tools; specifically, software that can help us to locate and create information, either individually or collaboratively. When we've been learning about the Internet, for the most part, we've been learning to use Internetworked tools.

Yet, as teachers, we know that tools, no matter how powerful their educational potential, don't directly help our students to learn. What's important is how we use the tools to assist teaching and learning. In other words, there is a big and important difference between: using the tools (operation) and using the tools (application).

Operating Internetworked tools is an important, but merely prerequisite step toward creating powerful telecollaboration and teleresearch in our classrooms. How to *apply* the tools in curriculum-based educational activities, although less frequently the target of careful thought and in-depth investigation, is a much richer, more complex, longer-term, and more critical area for educators to explore at this point in time.

Lesson Plans? Not!

Can you remember an instance in which you "borrowed" an idea for an activity or project that had worked well in another classroom? The idea might have been successful with students whose ages, backgrounds, and interests were similar to your students'. The curricula for both groups of pupils might have been comparable. And yet, think back and remember what happened when you last tried to "plug and play" an idea from another classroom into your own. How well did it work? How well did it *really* work? Not so well, eh? If it was successful, think carefully about what you did while you were planning its implementation. You had to *change* it a bit to get it to work well with your students, didn't you? And, if you didn't think to do this—perhaps when you were much less experienced as a teacher, or when you were particularly pressed for preparation time—the activity fizzled, now didn't it?

Why is this so? Why does the same educational activity triumph in one classroom and falter in another, even when the students, curriculum, and materials are very similar? As teachers, the answer to this question is obvious to us. Conditions among classrooms are quite variable. Students are different; teachers are different; resources available for teaching and learning are different. Prior experiences and content-related comprehension for both teachers and students are different. Group dynamics are different. Differences can even be caused by the time of day, week, month, or year at which a new activity is introduced. If we know of these biologically, psychologically, socially, historically, and temporally rooted differences among students' receptivity to educational activities, then *why* do we believe, even for a minute, that we can successfully "plug and play" someone else's wonderful project into our classroom?

The answer, of course, is that most teachers *don't* really believe that learning to apply a new tool educationally is just a matter of "plug and play." Most of us know to "tweak" an idea to fit the unique nature of the context (learning styles and preferences, teaching styles and preferences, past experience, resource availability, etc.) in which they work. We expect to learn from mistakes and unexpected reactions when an idea is first implemented. Yet we know from both experience and research (e.g., Rogers, 1995) that tweaking someone else's idea isn't nearly as satisfying, or as effective, as *designing* an activity that fits the unique combination of factors that present themselves in any particular classroom at any particular point in time. Reinvention, the process of taking something like a new tool or idea and making it our own in its application, is very important to both teachers and students. Feelings of ownership are crucial if new tools are to continue to be employed in ways that will benefit users. This is what is known as true adoption of the innovation (Rogers, 1995).

When we are asked to wade through large collections of lesson plans, replicate projects from other classrooms, or follow overly prescriptive directions for educational activities written by folks who can't possibly know our students as we do, we are asked to ignore much of what experience and reflection have taught us. Using Internet tools and resources in our classrooms in ways that will benefit students and teachers—in ways that are truly worth the time, effort, energy, and expense—call on us to function more as *instructional designers* than direction-followers. Creating and implementing learning activities as a designer is an artisan's endeavor. I speak to you as that artisan; analogically, as chef rather than cook; conductor rather than metronome; educator rather than automaton.

I can hear what some of you are thinking now: "I don't have time or space in my curriculum to be an artisan!" It's true that as the years pass and our schools and communities change, preparation time for teachers dwindles, while demands for additions to our curricula increase in number and complexity. So, I won't be suggesting that you "reinvent the wheel" or add anything more to your already-crowded program. Instead, I will propose the use of some "Wetware tools," or thinking apparatus, that will help you to engage in the important design processes that we know are essential to powerful, regular use of new tools in our classrooms. These thinking tools are created in such a way that they can assist your design work in a time-efficient, energy-conserving manner.

Is it "worth it?"

What's one way to save time and energy in our classrooms? Choose educational activities that give students maximal return for the amount of time and effort that all of us must expend to ensure success. There is a point of diminishing returns, the "location" for which each of us estimates when we consider the implementation of a new technique. In a phrase, we decide whether the new application is worth it. In terms specific to educational telecomputing, is a particular use of an Internet-based tool or resource in a particular situation for a particular group of students and teachers worth the time, effort, and expense that it will take to use the tool or resource in this particular way? Note that this is not a unilateral decision about all Internetworked information and implements for all time. Instead, the "Is it worth it?" test is applied *each time* the use of the Internet is considered in an educational situation. That implies that answers to the "Is it worth it?" question will change as people and resources change. The ease and speed of Internet access in your school and classroom will continue to change. What is possible and available on the Internet will continue to change. As you and your students learn more about and do more with Internetworked tools and resources, you will continue to change, too.

How can we best make this decision each of the many times that we will be called on to do so, to help others in doing so? I suggest that, keeping in mind a specific, feasible educational use of the Internet, and both content and processes that students need/want to learn, we consider the honest answers to two questions:

1. Will this use of the Internet enable students to do something that they *couldn't* do before?

2. Will this use of the Internet enable students to do something that they *could* do before, but better?

If the honest answer to both of these questions is "no," there is no reason to use Internet tools or resources in the way that we are considering. Our time, effort, and resources would be better used in another way. In any particular instance, if using traditional tools and approaches can allow students to learn just as well or better than using new tools and approaches, it doesn't make sense to use new tools in traditional ways. It isn't "worth it" to do so, for students or for teachers.

How can we, as teachers, use telecomputing tools and resources in powerful, curriculum-based ways that are "worth it," making sure that we function as instructional designers without overburdening an already-challenging workload and schedule? We can consciously use a set of design tools, along with a wealth of corresponding real-world, classroom-tested project examples, to efficiently and effectively create curriculum-based activities for our unique classrooms. These design tools are not prescriptions, or step-by-step directions, or blackline masters. They are a special type of thinking tool that I call an activity structure.

Wetware Tools: Activity Structures

What's an activity structure? Let me begin by telling you what it's *not*. It's not a model, template, plan, mold, or example. It's a flexible framework, much like the wooden frame of a house or the skeletons in our bodies. Its basic shape is clear, strong, and simple, but, as with houses and humans, the same frame can support a myriad of different architectural or bodily expressions. The structure literally holds up the house, *creating spaces* for living. In a similar way, activity structures can support the generation of powerful educational environments, or spaces for learning and teaching, that are constructed, decorated, and used in customized and ever-changing ways, according to the needs and preferences of their inhabitants.

The activity structure is a teacher's instructional design tool; a piece of "Wetware." It is a way for us, in our conversations with ourselves and others, to capture what is most powerful in a particular type of learning activity, and communicate that in such a way as to encourage the creation (not replication) of individualized, context-appropriate environments for learning. It's as if the activity structure is the frame of the house, resting firmly on the conceptual foundation of this architectural approach to building potentially powerful learning spaces. The frame gives shape and strength to the actual learning activity, but it is completely flexible, so that the walls, roof, doors, windows, and decor are content-specific, student-centered, individualized according to preference and past experience, and reflective of locally available resources. The same frame can support many houses whose external appearances and intended functions are actually quite different.

There are 18 telecollaborative activity structures that I have identified to date. They group themselves into three genres of educational online activity.

Interpersonal Exchange

- keypals
- global classrooms
- electronic appearances
- telementoring
- question-and-answer activities
- impersonations

Information Collection and Analysis

- information exchanges
- database creation
- electronic publishing
- telefieldtrips
- pooled data analysis

Problem Solving

- information searches
- peer feedback activities
- parallel problem solving
- sequential problem solving
- telepresent problem solving
- simulations
- social action projects

Want to learn more about activity structures for curriculum-based telecomputing projects? Additional information is available on the NECC '98 conference CD-ROM. And, a more in-depth exploration of designing and directing K–12 telecollaboration and teleresearch can be found in the book, *Virtual Architecture: Designing and Directing Curriculum-Based Telecomputing*, published by ISTE and written by your humble author. As a matter of fact, you have just read some of the first chapter. (grin) I hope that you now want to read more.

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General Session: Exhibitor Session/Curriculum Design/Strategies

The Computer Doesn't Embarrass Me

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Key Words: technology, reading, literacy, at-risk, intervention, middle school

Middle school students in more than 120 Orange County Florida classrooms are improving their reading and writing skills thanks to a joint effort between the Orange County Schools and Peabody College of Vanderbilt University. Recognizing that many students entering middle school could not read and write at even basic levels, Orange County administrators and teachers decided on an ambitious undertaking, called the Orange County Literacy Project (OCLP), to attack this problem. The OCLP combines the benefits of computer technology, sound principles of literacy instruction, an accommodating schedule, and small class sizes to help students develop the skills and confidence they need to be successful in content area classes.

The OCLP was first piloted in three Orange County middle school classrooms during the 1994–95 school year. The project has grown to include nearly 4,000 students in Grades 4–9. Project teachers base their instruction on two complementary approaches to developing literacy: (a) The Peabody Learning Lab (PLL) software and (b) the Literacy Workshop (Allen, 1995), a method of teaching that encourages students in reading, writing, speaking, and listening activities. Each OCLP classroom is supplied with five computers capable of running the PLL software, and all teachers are given more than a week of professional development on the literacy project.

The Peabody Learning Lab software, based on several years of empirical research conducted at Peabody College of Vanderbilt University, capitalizes on the power of integrated media technology. The program mediates instruction in word recognition, decoding fluency, and spelling as well as the comprehension of text passages. Instruction is centered around contemporary topics that are presented through a video anchor. An animated tutor guides the student and provides feedback through a digitized human voice. The program tracks individual student progress and adjusts the instruction accordingly.

A comprehensive set of data collected during the first two years of the pilot study included measures of reading achievement, overall school achievement, and student behaviors and attitudes. Average vocabulary and reading comprehension subtest scores of the 376 students on the Stanford Diagnostic Reading Test improved significantly over the course of the program. Significant gains were noted on the Culture-Free Self-Esteem Inventory and the Test of Written Spelling. School attendance and grade point average also improved.

As pleased as we were by the statistical data, it was the comments by students and their parents that led us to believe that the OCLP program was working and should continue. More than 50% of the students interviewed made comments like “My reading and study habits have improved” and “I no longer fear or dislike reading.” The combination of a skillful teacher and well-designed software helped students improve their skills and strengthen their frail self-concept. As one student put it, “I don’t mind reading now because the computer doesn’t embarrass me.”

Scholastic, Inc., is partnering with Vanderbilt University to publish and distribute this literacy intervention program and plans completion of the product in early 1999.

Internet Poster Session

Online Professional Development: A Viable Alternative to Traditional Methods

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Key Words: professional development, online resources, Internet, staff development

Description

Online Professional Development is being offered on the Internet, http://www.cms.k12.nc.us/, to more than 6,000 teachers and administrators in the Charlotte-Mecklenburg Schools.

Summary

This presentation will show how Charlotte-Mecklenburg Schools (CMS), a public school system located in Charlotte, North Carolina, which serves more than 92,000 students and 6,000 teachers is using a new approach to professional development. Delivering professional development to teachers has become more and more difficult because of restrictions on time, driving distance, movement of personnel, and resources. The growth of the Internet and the rich variety of resources that are available 24 hours a day has caused a paradigm shift in the way professional development is delivered. It is no longer necessary for teachers and administrators to assemble in a predetermined location at a predetermined time for professional development.

Charlotte-Mecklenburg Schools is making professional development opportunities available to teachers and administrators through the Internet and its own award-winning Web site, http://www.cms.k12.nc.us/. Through this endeavor teachers and administrators learn how to use e-mail, Web browsers, and other electronic resources as tools to enhance instruction and improve student achievement.

The benefits to this approach for providing staff development:

- Professional staff may participate from home, school, or the public library.
- Professional staff may advance at their own level.

- Professional staff would not have time limits or schedules to adhere to.
- Professional staff may register for the workshops electronically.
- Professional development will be delivered at a substantial savings over traditional methods in which success is sometimes measured by seat time.

A second tier of this online professional development program provides opportunities for teachers to submit lesson plans to a centralized database that is correlated to the North Carolina Standard Course of Study. The database located at www.learnnc.org provides an easy-to-access bank of lesson plans designed by teachers from across the state. Teachers will be able to submit lesson plans that will be reviewed by a team of teachers for safety, accuracy, and content. These lesson plans will be available to all teachers in North Carolina through the LEARN North Carolina Web page.

Other types of online professional development will be added as modules are created by the Professional Development Staff. Commercial products may also be added as they become available at a later date.

General Session: Emerging Technologies

Technology ... A Beacon for Change

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Key Words: educational reform, teaching strategy, technology plans

Like the changing of the tide, our children live in a very different and ever-changing world. These societal changes have had an impact on how learning takes place in the classroom. As educators, we began to acknowledge that we needed to change our teaching practices to better prepare children and meet their needs. Like the beam of light from a lighthouse, we searched to evaluate how children learn. One question came to the forefront, "How do we first *reach*, and then effectively *teach* the children of today?" We began to explore teaching practices and strategies that actively engage students in the learning process. Through research, reading, parent and staff discussions, the Chapelwood staff began trying various teaching practices and strategies, such as project-based learning, interdisciplinary curriculum, and technology integration. The newly identified teaching practices became practices for constituting change. The strategies and methods became a catalyst for changing the way Chapelwood teachers teach.

Technology became the small ripple in the water that created a wave for change. Using technology as a catalyst for change also plays a viable role in increasing student achievement. Curriculum and technology connections create a more challenging and motivating learning environment. Learning emerges to new heights through the integration of curriculum-related software and the Internet. Students have educational resources and information from all over the world and beyond, right at their fingertips. The beam of light from the lighthouse began to span to all learners.

Teacher productivity and methodology also changes with the use of technology. Educators begin shifting the paradigm and valuing their role as the facilitator of knowledge. For many educators, technology sparks a new beginning and a change in teaching strategies.

Through a partnership with IBM, Chapelwood was named a "Lighthouse School."The title "Lighthouse School" means that Chapelwoodreceives the latest software and hardware available to put in the hands of teachers and students. In our presentation, we will take participants on a journey of our implementation of a technology plan. Participants will hear valuable information regarding how to evaluate the present, plan for the future, and implement with technology. Benefits that take place through the use of technology in the classroom and personal reflections from administration, teachers, and students will also take place in this session. A question-and-answer session will conclude the presentation.

National Educational Computing Conference 1998, San Diego, CA

General Session: Curriculum Design/Strategies

Phonics-Based Touch-Typing and Writing With Computers Boost Primary Reading Scores

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Key Words: writing, reading scores, writing software, reading research

Abstract

Writing is a process that can integrate the best of phonics and whole language approaches. It engages children actively in using phonics to sound-out the words they need to express ideas, record information, and create stories. Two independent studies have found significant improvement in first-grade reading and spelling after students used a phonics-based touch-typing and writing software curriculum.

The first study has been carried out by California Neuropsychology Services (CNS), a nonprofit organization for research and professional development in education. Funded by the Knight Foundation, the Writing Wagon Project rolled three red wagons, each loaded with 10 laptop computers, into five first-grade classrooms three times a week, November through June, to provide extra phonics, reading, writing, spelling, word processing, and keyboarding instruction. *The Writing Wagons* come with new research-based software called Read, Write & Type (RWT) developed by CNS over a 10-year period.

With this computer-based approach, students associate each phoneme with a letter and a keystroke on the keyboard. They use eyes, ears, mouths, and fingers to sound-out and type hundreds of words, phrases, and sentences in a 40-level animated interactive curriculum.

RWT has also been used this year by Dr. Joseph Torgesen at Florida State University in reading research funded by National Institutes for Child Health and Development. RWT boosted reading scores with first-grade students who were selected in kindergarten as at-risk for reading difficulties. Most were reading at grade level or above by the end of first grade.

We will report research results, show the computer program (using computer projection device and screen), and show a video of teacher activities and students in the classroom.

General Session: Exhibitor Session/Teacher/Professor Productivity

The Future Is Here: Automating Your District

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Key Words: productivity, curriculum, technology, assessment, management, title1, reporting

Imagine a completely automated instructional program. Teachers use software to complete their lesson plans. Each activity is keyed to a curriculum objective or standard. When the student completes the assignments and tests on that lesson, the work is scored electronically and the grade is automatically recorded. The grade is also linked to the objective or standard taught. When the student takes the standardized test (electronically) used in that district, the teacher retrieves the scores of the students and compares the test scores with scores earned on the activities used to teach that standard or objective and amends lessons as necessary. Reports on the student's progress are available to the student and to the parents on a frequent and as requested basis electronically or over the phone. This is the ultimate data-driven curriculum.

Federal and state funding initiatives are providing school districts the opportunity to build the technology infrastructure necessary to automate all areas of the district, from the administrative offices to student support services to school buildings and classrooms. With the networks in place and funds to provide workstations where necessary, districts now must find and select the appropriate software to meet their needs. The software to connect all the data is not yet available, but many of the components are already available. The curriculum, available online, provides the teachers the information on the resources available in the district that can be used to teach each standard or objective. Customizing features that allow the district to download their current curriculum directly into the database program are also available. Technology can also be used to streamline classroom management and provide new uses for instructional management and assessment. Software is available to automate reporting for state and federal programs and for special education. For instance, a software program exists that can download observables from a Newton into its database that can then be directly available for state and federal reporting.

Software is available to automate every area of district offices. School districts have used student information systems, financial systems, and human resource systems for many years. Now, with school districts wired with wide area networks and classrooms equipped with computer workstations, it is possible to extend the automation to the curriculum offices and to classrooms. This presentation will discuss what can be automated in the curriculum, instructional management and assessment, and classroom management, which includes reporting for special programs. This session will provide an overview of how to use technology to automate and improve processes in curriculum design and development, instructional management and assessment, and classroom management.

General Session: Exhibitor Session/Special Needs

Access to Curriculum for Students With Disabilities: An Overview of IntelliTools Creativity Tools

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Key Words: adaptive technology, special education, disabilities, inclusion, curriculum adaptations, language arts

Computers can provide enhanced physical and cognitive access to learning materials for students with disabilities. As more students with disabilities are being included in classroom settings, teachers, technology specialists, and administrators need information about software and hardware tools to make curriculum accessible. Since 1979, IntelliTools has been providing access to technology through hardware and software solutions. IntelliTools provides training, technical support, and an interactive Web site with ideas and activities shared by teachers around the world. The Web site address is http://www.intellitools.com/.

The use of adaptive tools fosters independence and enables students to focus on the task and not the challenge of doing the task. However, most educational software requires students to use a mouse and a standard keyboard. Students with limited physical mobility or poor motor planning are unable to use a mouse. Other students are challenged by the complexity or layout of the standard keyboard. For these students, IntelliKeys, IntelliTalk, Overlay Maker, ClickIt!, and IntelliPics from IntelliTools can provide customized hardware and software access solutions, including access to popular educational software. In addition to issues of physical access, software-based curriculum materials offer students with disabilities unique learning advantages. By providing visual, auditory, and kinesthetic learning, these students demonstrate greater skill mastery.

The IntelliKeys alternative keyboard can be used in a Mac or PC environment. Two switch ports allow users to interface with any switch software available. A set-up overlay makes it easy to adjust settings like keyboard response rate.

A student who has difficulty reading text independently can use the talking word processor, IntelliTalk. IntelliTalk reads and highlights every letter, word, and/or sentence. Students interact with text in a multisensory environment. Teachers can create template materials that foster independent learning.

Entering text using letters, words, or sentences is easily accomplished using the IntelliKeys keyboard and overlays created using Overlay Maker. Students learn language pattern by combining words on the overlay into sentences. The I Can Write Strategy Series gives teachers a step-by-step method for teaching beginning writing skills using IntelliKeys, IntelliTalk, and Overlay Maker. This method consists of two approaches, writing letter by letter and word by word.

Learning activities enhanced with graphics and text can be created in the multimedia program, IntelliPics. Activities can be customized using a variety of graphics and made accessible by mouse, IntelliKeys, and switch.

In addition to creativity tools, IntelliTools has created high quality, ready-made, accessible curriculum solutions for language arts and math to meet a variety of student needs.

Additional Internet Resources: The Alliance for Technology Access Web page: http://www.ataccess.org/.

Workshop

Excite Your Language Arts Curriculum With Video

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Key Words: language arts, video, research, American Dream, poetry

The language arts curriculum fuses video curriculum in three areas: the research paper, the American Dream, and poetry. After students have completed a five to seven page, MLA style research paper, they present the information. Students usually combine similar topics, but one group combined their information on television violence, children of divorce, alcoholism, and how behavioral science is using the whale in a soap opera called "As the World Falls."

The poetry project has also been changed with the use of technology, combining both guidelines and student freedom to choose the end product. The project includes an author and era summary, reading of the poem, paraphrase of the poem, poetic devices used, and a discussion of the theme of the poem. Besides the use of video, this project is enhanced by turning the classroom into a coffee house. Students learn that poetry has deep roots in coffee houses, and they enjoy their own coffee or other snacks. The American Dream investigation allows students to conduct original research. Students set up a time to interview a person at least two generations older than themselves, asking enough questions to determine what the American Dream is, if it still exists, and if it has changed. The project is then presented to the class as a portfolio or a videotape. One of the students actually videotaped the land her ancestors had homesteaded with a voice overlay of her grandfather talking about the land and how farming and schooling have changed.

Using video to enhance curriculum requires a program that is quick and easy to learn. That program is Avid cinema, a complete solution for creating professional-looking movies right on the Macintosh. Students shoot the video, bring it into the computer, edit, and see the finished movie. They have the flexibility of making a full-screen, full-motion videotape, or saving it for publishing electronically on the World Wide Web, as a CD-ROM, or as an on-screen presentation.

The tab design allows students to create a story board, bring video in, edit and send movie out. After students make the storyboard, they bring video in shot by shot, assemble, and edit; the timeline tab shows all clips in the order in which they appear in the final movie. The edit tab allows students to add effects, titles, sound, and graphics. In the viewer tab they play the movie, rearrange sections, trim, superimpose, scroll, and change size, font and color of text. The sound tab allows either external or internal microphones, original sound, or imported music tracks. Students can add a variety of media files in the library tab including scanned-in photographs, graphics, music, sound effects, and QuickTime movies.

Because Avid Cinema is easy to learn students do not become frustrated with the final step of their project, production.

General Session: Education Reform and Issues

Reforming and Restructuring the Chicago Public Schools Through Technology Initiatives

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Key Words: community, initiatives, LAN, reform, restructure, standards, WAN

The nationally acclaimed school reform and restructuring programs of Chicago Public Schools have been closely integrated with technology initiatives. A panel of local experts will discuss the integration of technology initiatives with social and professional reorganization. Members of the panel will first discuss the superstructure of the reorganization efforts. A second round of discussions will describe the infrastructure of reorganization implementation. Questions will follow.

In the superstructure round of discussions, members of the panel representing the Illinois State Board of Education and the Chicago Public Schools, Department of Learning Technologies will describe the state and district roles in reorganization. Other panel members will present a local school case study and publicity, especially Web-page design of the programs.

In the infrastructure round of discussions, panelists will describe the four components of a state-approved, three-year, school technology plan: staff development, engaged learning, community participation, and technology deployment.

Following the formal panel presentation, questions will be answered regarding the technology-based top-down restructuring and bottom-up reforming of Chicago Public Schools.

General Session: Educational Reform and Issues

Mystery of the Mission Museum: VR Environments for Student Interpreters

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Key Words: virtual reality, VR, museum, museum interpreter, situated cognition, interactive, multimedia

What Is VR and What Does It Have to Do With Learning?

Virtual Reality (VR) means many things to many people. To kids it spells video games. To airplane pilots and tank drivers it means training simulators. To doctors it means telemedicine. What all these examples share is the ability of the user to interact with virtual objects in an integrated environment. Whether expensive "full immersion VR" using head-mounted displays (HMDs) and "data gloves" or suits, or "through-the-screen VR" using garden variety multimedia computers with ordinary monitors, speakers, mouse, and keyboard, users manipulate objects in rich contextual environments.

For us as educators, through-the-screen VR is appealing because of its low cost and accessibility to students and teachers. Examples of through-the-screen VR projects include children's programs like *Freddie Fish and Putt-Putt Saves the Zoo* (both Humongous Entertainment, 1996), or the recent *Dinosaur Hunter* (DK, 1997). Through-the-screen is not just for children, though, as evidenced by sampling *Who is Oscar Lake?* (Language Publications International, 1997), a virtual foreign language learning adventure.

Virtual environments, no matter how remarkable as VR, are no better than the instructional design that goes into them or wraps around them. Here's an example of how to use one project, a virtual California mission, designed to help fourth-grade students learn to serve as museum docents, and, in the process, learn about California's colonial past.

The Mystery of the Mission Museum

The Mystery of the Mission Museum transforms students into amateur historians and interpreters of the past. The VR part of the project is a fictional California mission synthesized from several real missions. It is a QuickTime VR project, created in Strata StudioPro and delivered on CD-ROM using Macromedia Director.

The curriculum accompanying the Virtual Museum prompts students to study the daily life of the missions and the mission system. Their research takes them beyond the computer environment to print-based books, photos, illustrations, the World Wide Web, excavation sites, actual artifacts, museum displays, and interviews with present-day Native Americans, historians, park rangers, museum staff, and others, for clues and information about the ways of life in that place and time.

Using traditional interpretive techniques, students then develop their own presentations based on the outcomes of their research. For example, they might create a presentation on a day in the life of a Native American child their own age or about different tools used in the missions. They might research how the mission Indians and padres constructed their buildings or what they grew and ate. The students then give their presentations to real audiences: their classmates, family, community members, and others. Some may actually go on to exercise their skills in a real museum.

The students' thematic presentations put the history of the era into an interdisciplinary context that incorporates elements of natural history, math, science, technology, and language arts. For example, part of effective interpretation and presentation involves the use of visual and hands-on support materials. Students create timelines, maps, and graphic population charts to represent different groups of people (Native Americans, Spanish soldiers and clerics, etc.) who lived and worked in the missions.

In the process, students become independent, lifelong learners, who can find, evaluate, and use a variety of resources beyond the classroom, and who appreciate the value of museums and museum interpretation.

How Does VR Promote Learning?

While few virtual reality educational products presently exist, several authors have pointed up the potential of VR for educational purposes. They cite the multidimensional, inclusive or "immersive" qualities of the VR environment that engage and motivate learners, and the active participation that results.

One of the main defining attributes of VR has been the claim for active participation by the learner in the context. By the very nature of the interface and the three-dimensionality of the interaction with the context, the learner is compelled to take an active role in the interaction (Hedberg & Alexander, 1992).

A theme in the literature on individual learning styles is that, on the whole, a given group of students will learn more easily in an environment in which there are a variety of modalities for interacting with new information. Virtual reality provides such rich environments, combining text, visual and aural information, and even temporal and spatial cues for learning.

Dede (1995) takes the idea a step further by asserting that VR is an ideal tool for situated, constructivist-type learning experiences. This instructional approach enhances students' ability to apply abstract knowledge by situating education in authentic, virtual contexts similar to the environments in which learners' skills will be used (p. 46).

The Mission Museum's docent-training curriculum provides such a context, and one that involves collaborative activity as well. As Lave (1988) describes, again with respect to virtual environments, "Learners appear to learn mostly in relation with their peers. Where the circulation of knowledge amongst peers is possible, the knowledge spreads rapidly and effectively."

Auld and Pantelidis (1994, p. 29) list a variety of ways in which VR can enrich traditional learning, among them:

- explore existing places and things that students would not otherwise have access to
- explore real things that without alterations of scale in size and time, could not otherwise be effectively examined
- interact with virtual beings, such as representations of historical figures and agents, who are representatives of different philosophies and viewpoints

Winn (1996) observes that, particularly with respect to scientific phenomena, much teaching involves simplifying the content to make it easier for beginning students to learn. He points out that this often prevents students from appreciating the true complexity of phenomena. In addition the use of symbol systems alone often divorces students from connecting the phenomena they're studying with the world around them, resulting in deeply entrenched misconceptions. He suggests that VR may give students more direct manipulation of objects and feedback than they can obtain by manipulating symbols alone.

The potential of virtual reality is as yet relatively untried for entertainment, let alone educational purposes. The Mystery of the Mission Museum and similar projects represent first steps in exploring the use of this promising technology for learning and teaching.

Workshop

Constructing a Wireless LAN and WAN

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Key Words: wireless, LAN, WAN, spread spectrum, infrared, network

The cost of the necessary technology and the ease of installing it have now reached a point where a wireless network is a reasonable option for many educational institutions. Like any network a wireless network requires careful planing and design. The first questions that need to be asked include what is the network function today, what will it be tomorrow, and what can we install today to make sure the network is usable in the future.

Up until a short time ago, about 18 months, wireless networks consisted of two types microwave and infrared. The microwave networks were expensive and difficult to install. The infrared networks, while inexpensive and easy to install, were slow and very limited by distance. About 18 months ago, spread spectrum technology was made available by the military to the public sector.

Spread spectrum technology is not new. The first patent for a spread spectrum device was issued in the early 1940s. The concept of spread spectrum is very easy. The radio signal that carries the information is broadcast over a large number of frequencies, making the radio signal difficult to jam or to be interfered with.

So why should an educational institution consider a spread spectrum network. Let's take a look at the cost of a spread spectrum network. An external link connecting two buildings together can range from $6,000, for a 3-megabit link to $15,000 for a fully duplex 10-megabit link. One of the major reasons to link buildings together is to reduce the cost if Internet connection. In many cases the cost of a 3-megabit link (twice the speed of a T1 line) is equal to the cost of four months lease from the local telco.

National Educational Computing Conference 1998, San Diego, CA

Internet Poster Session

Museums in the Classroom: Illinois Inventors and Authors

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Key Words: museums, Illinois, inventors, authors

Educators and policymakers nationwide recognize the need for students to become global learners—to reach beyond their classroom walls to acquire knowledge and skills. The Illinois State Board of Education has provided this opportunity to Jefferson Elementary School classrooms—one fifth and one sixth grade—by pairing them with the Southern Illinois University at Carbondale Museum. Researchers at the museum have lent their expertise to students in providing extensions for classroom learning. Students have developed a myriad of skills in the area of research, technology, cooperative learning, and telecommunications. Using these skills, students have produced a Web page featuring inventors and authors from the state of Illinois.

Authors included range from children's authors, Richard Peck and Irene Hunt, to the current best selling author, Michael Crichton. Authors native to Illinois or who are current residents were the focus of the students' research. Students read and critiqued the novels and created an online project using 3-D dioramas and photography of objects that were representative of their chosen novel. For example, students reading Jurassic Park by Michael Crichton used dinosaur bones, which were photographed to create an object movie.

Inventions fell into several categories, including home life, medical technology, architecture, farm life, and arts and entertainment. Many of these inventions were illustrated with object movies to allow the viewer to manipulate the object 360 degrees.

The Web page continues to be a student driven and generated project that has included their own input, preparation, and research. Students have become adept at using Macintosh computers and programs. They have also had access to the QuickTake camera, flexcam, scanner, and the use of QuickTime virtual reality technology to make object movies. The project continues to expand and has been used in classrooms for the past three years; it will continue to grow into the next millennium. The Web page has been accessed and used for additional research and reference materials by people across the United States and has shown the students that their acquired knowledge and projects do make a difference.

Paper Session

Building Capacity for Innovation: The Vanguard for Learning Model

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Key Words: reform, innovation, model schools, capacity-building, Department of Defense Dependent Schools

Abstract

When a school community is making a major investment in technology, the major challenge is to ensure that the technologies are used to support innovative practices that are responsive to the community's changing needs and opportunities for teaching and learning. How can implementation of technology be integrally embedded in and supportive of innovation and reform? How can a local school community build its own capacity for innovation while at the same time staying in synchrony with top-down and system-wide initiatives? How much innovation can a school adequately support at any one time? Can these locally initiated innovations become institutionalized? Can the local community be a research testbed to feed back information to the larger system? These questions are being addressed in the pre-K–12 school community of a U.S. military base overseas, which is part of the U.S. Department of Defense Education Activity (DoDEA) worldwide school system. Vanguard for Learning is a 30-month research project sponsored by the DoDEA and funded by the National Science Foundation to investigate these questions about technology and educational reform. This paper provides an overview of the Vanguard model for innovation and some key findings to date. More information and research findings can be found at http://copernicus.bbn.com/vanguard/.

The Vanguard Model for Innovation

The goals of Vanguard for Learning are to:

- learn how to build a school community's capacity to initiate, evaluate, and institutionalize new ways of learning and teaching
- use innovation efforts in that school community to investigate selected key components of reform that can inform DoDEA system-wide practices
- use lessons learned from Aviano and DoDEA to advance

understanding of systemic reform processes in education generally

The Vanguard for Learning project, as a model for educational innovation, includes seven key components. These components include the following:

- local community planning
- high-leverage strategies derived from both system goals and local opportunities
- capacity-building goals and indicators of change towards them
- capacity-building teams across the community
- Team Action Plans (TAPs)
- external facilitation
- research agenda

The core ideas behind the Vanguard model are that (a) innovation needs to be grounded in the interests, abilities, needs, resources, and constraints of a particular local community while at the same time staying in synchrony with and helping to inform initiatives from the larger school system of which the local community is a part; and (b) an infusion of computer and communications technologies into the schools may be a catalyst for but should not be the central focus of educational innovation. Professional development is embedded in all components.

1. Local Community Planning

The planning process engages a wide range of stakeholders across an entire local school community, which includes all of the pre-K–12 schools serving the families of a military base. Over a six-month period from November 1995 to April 1996, teachers and administrators, students, parents, and military personnel at Aviano Air Base considered what it means to them to serve as a Model School for DoDEA, in the context of their own plans, priorities, and resources. This planning included the following processes:

- begin creating a culture in which reflection and innovation are valued and expected of everyone. To stimulate this process, teachers, parents, administrators, and military proposed many promising ideas for innovative practices and projects.
- begin creating and articulating a shared vision of reform, which is a central component of organizational capacity. (O'Day et al., 1995; Means & Olson, 1995, p. 165). The Linking for Learning strategies described below are a beginning step in the development of a shared vision.

- introduce a process for initiating, planning, implementing, and evaluating classroom level innovations and projects in support of the school-wide change priorities. The TAP described below was introduced and all teachers and administrators were invited to participate.

- develop and refine an understanding of both local and systemic conditions required for such change processes to take place, including leadership and human and technical infrastructure

2. Constructing High-Leverage Strategies

Overall strategies help ensure that out of an infinite number of possibilities for changed practices, the community focuses on certain themes having the greatest likelihood of making a difference for a large proportion of learners. These themes helped to foster the continued building of a common vision across the community. The Aviano Vanguard high-leverage strategies were built on an analysis and integration of the following:

- priorities of the DoDEA leadership and Strategic Plan. At the system-wide level, the DoDEA Strategic Plan (DoDEA, 1995) identifies goals, such as raising test scores, building relations between the community and the schools, and closing the gap between majority and minority students, that provide the direction for major reform of the entire system to meet demands of changing society. A growing reform literature (e.g., Fullan, 1993, 1996; McLauglin, 1992; Tyack & Cuban, 1995) is documenting the fact that successful reform must involve all levels of the system coming together in consensus about what reforms they want to pursue. That process involves teachers, administrators, parents, and students from the school communities, and administrators and curriculum specialists from the district and central offices in joint decision making to develop clear understandings about roles and expectations. DoDEA leadership has instituted a number of processes aimed toward engaging all members of the schools' communities in these reform processes. These include, for example, the School Improvement Process (SIP), professional development strategies, site-based management, Program Quality Review processes, performance standards in all subjects, and technological infrastructure that will enable better communications and information management.

- interests, special capabilities, and priorities expressed by people in the Aviano school community and Air Force Base and the Italy District Superintendent's Office. This school community has experienced a high level of stress over the past several years because of the build-up of the Aviano Air Base, very restricted physical space and facilities, and growth of the school population, in addition to the more typical pressures of implementing new curriculum standards, a new system-wide School Improvement Process, and other systemic changes.

- knowledge derived from research and effective practice in learning, teaching, and school reform; (e.g., Hodges, 1994; Mehlinger, 1996)

- opportunities offered by modern technologies to strengthen and leverage the resources and innovations. Over the past three years these schools have received substantial equipment and network resources from several different sources.

Aviano Vanguard Strategies: Linking for Learning

By strengthening and creating linkages among people and content across the curriculum, among the families and military commands in a school community, and among DoDEA schools, people at all levels are able to take on new roles as leaders of innovation and supporters of each others' learning and development. Linking for Learning goes beyond making incremental improvements in existing practice. It leverages human, informational, and technological resources across three levels of innovation.

Linking Across the Curriculum: Increasingly educational reformers argue that all students should have the opportunity to practice and apply skills and knowledge within the context of tasks that are personally meaningful and challenging (Collins, Brown, & Newman, 1989; Resnick, 1987; Means, 1995). The DoDEA Community Strategic Plan recognizes that "We are expected to impart more complex knowledge, cover additional content, and foster the application of information to solve present and future problems … our curriculum must become more integrated … integration of content across curriculum domains, clear connections with the world outside of school, diversity … and associated instructional practices (e.g., teamwork, active student participation in learning …." However, the reality is that the curriculum is separated into subject areas, and there are required textbooks across the system. Hence, linking across the curriculum is very challenging at this time.

Linking Across the Community: Research confirms that regardless of the economic, racial, or cultural background of the family, when parents are partners in their children's education, the results are improved student achievement, better school attendance, reduced dropout rates, and decreased delinquency (e.g., McCaleb, 1994; Snodgrass, 1991; Illinois, 1993). The DoDEA Community Strategic Plan emphasizes the importance of parental participation: "For our students to receive the maximum possible benefit from their educational experiences, parents must be full partners in their children's education. To accomplish this goal, we must enhance our programs of school-home communication, parent involvement in school activities, parent involvement in student learning activities, and we must increase parent involvement in the decision-making process about their children's education."

(DoDEA, 1995)

DoDDS schools have special opportunities and resources for learning because of their special relationship with a military base and the skills and knowledge of its personnel. The relationship between the military commands, families, and schools in Aviano Air Base has offered extraordinary opportunities to advance learning. For instance, the commander of the air base, General Wald, initiated a mentorship program, established a paid civilian position to administer it, and encouraged group commands to allow personnel two hours per week of duty time to serve as mentors to school children.

Linking Across DoDEA: Linking across DoDEA schools is one strategy for sharing expertise and resources. Due to the global distribution of DoDEA there exist both special problems (e.g. logistics) and special opportunities (e.g. researching and sharing Host Nation cultural resources). As the DoDEA worldwide system implements technology—particularly Internet connectivity—over the next several years, the "virtual" classroom will offer more opportunities. Vanguard for Learning is testing ways of linking among schools through such activities cross-age tutoring, teacher collaborations, and networked projects.

3. Create and Monitor Capacity-Building Goals

As part of the planning process, Vanguard for Learning established 25 goals for building the capacity of the Aviano schools community to become a testbed for innovation for DoDEA, and ideas for how to achieve each of them. These goals were derived from prior research on effective school change and tailored to meet local conditions and opportunities. (Collins et al., 1994; Corcoran, 1995; Cradler, 1992; Dwyer et al., 1991; Goldberg & Richards, 1995; Griffin, 1982; Hodges, 1994; Hunter & Goldberg, 1995; Hunter, 1993, 1995; Hurst, 1994; Little, 1993; McLaughlin, 1993; Means & Olson, 1995; Means et al., 1995; Mehlinger, 1996; O'Day et al., 1995; Sheingold, 1991; Watts & Castle, 1993). These goals, in Aviano and the Italy District, included the following:

- shared vision across community
- culture of reflection, innovation
- process for initiating and planning projects
- adequate technology access for teachers
- capability to locate, explore, evaluate resources
- teacher access to expertise, knowledge
- collaborative teams among faculty
- teacher capacity for managing student-centered, project-based, inquiry learning
- teacher fluency in using appropriate technology tools

- teacher capacity to administer, score, and interpret multiple ways of assessing student outcomes
- teacher/staff ability to design action research studies
- reward structure for innovation
- teacher time for innovation, planning, collaborating, learning, and reflecting
- adequate technology access for students
- student capacity to provide tech support for teachers, students, users, and tech infrastructure
- technical support
- local decision-making process for resource allocation
- technical and administrative mechanisms for parent-school involvement and communications
- parent and base volunteers involved in curriculum content
- capability to link DoDEA Curriculum Standards and Aviano to innovative projects and resources
- coordination with other special projects, such as DARPA CAETI, President's 5-C's Technology Initiative; DoDEA Technology Planning
- cross-school student collaborations
- sharing innovations across DoDDS schools
- communications with District Superintendent's Office and DoDEA Headquarters staff

4. Forming and Nurturing Capacity-Building Teams

Existing organizational structures do not always have as their mission the kinds of capacity-building called for in the goals discussed above. In Aviano, four separate schools serve the families of the Aviano Air Base community. The organizational and geographic separation of these schools poses a challenge to community-wide collaboration. To build capacity across all the schools, we tried forming four new teams. These teams are the following:

Resource Advisory Team (RAT): This policy group includes the principals and assistant principals of all four schools, a School Improvement Leadership Team (SILT) representative from each school, and a Union representative. The RAT addresses issues of technology infrastructure, policy, and innovation priorities across the four schools. The greatest challenge to building a strong local management team has been the turnover in leadership. Four of the seven principals and assistant principals now on the RAT were not involved in the initial planning for Vanguard, and three of the original leaders are no longer in Aviano. Similarly, all of the SILT leaders have changed, as has the Union representative.

Student Enablement Action Team (SEAT): The SEAT is a for-credit course for students in Grades 7–12, providing them with skills in teaching and in technology. The SEAT is building a key resource to the teachers and other students across the school community.

Assessment Team: The AT is composed of two teachers or administrators from each of the schools, plus a staff person from the District Superintendent's Office. The AT is learning how to design and conduct assessments of student learning. The goal is for the AT to provide consulting services to the SIP and to the TAPs.

School/Home/Community Team: The S/H/C team is composed of parents, military personnel, teachers, administrators, and others who are building the community's capacity to foster stronger academic linkages between the school, the home, and the military. This team was extremely effective and creative during the 1996–97 school year, but nearly all of the organizers and participants had a Permanent Change of Station in the summer of 1997, and the team had to rebuild in the fall. One of the most promising innovations this team created is a physical location for each school called a School/Home/Community Resource Center where parents can go to learn about the schools, curriculum, and technologies.

5. Team Action Plans

TAPs are the core action component of the Vanguard model. The SIP provides an opportunity for schools to develop and implement school-wide changes in response to high-priority DoDEA benchmark goals. The Vanguard model extends the SIP by encouraging teachers to collaboratively construct, implement, and evaluate projects that support SIP benchmarks, and offering new opportunities and approaches to teaching, learning, and professional development. The process for accomplishing this is called TAP. In the Vanguard model, the TAPs drive innovation and requirements for professional development, and provide the context for research on systemic factors.

Small, voluntary teams are formed by teachers and others, to develop, implement, and evaluate projects that range from building new technical skills and teaching strategies to a full-scale action research project. The TAP process is built on research and experience from the California Model Technology Schools, other projects, and the action research tradition. (e.g., Cooley & Cradler, 1994; Noffke & Stevenson, 1995; Watt, 1995).

Fourteen TAP teams involving about 50 teachers, administrators, staff, and varying numbers of parents and students, formed in Aviano between January 1996 and August 1997. Table I summarizes key characteristics of these TAPs.

The Innovation Brief "Teachers in the Vanguard for Learning, Year 1" summarizes lessons learned during the 1996–97 school year about what makes effective TAP teams. In 1997–98, our focus is on institutionalizing the TAPs through the official SIP, so that existing teams are contributing to the assessment of student learning and sharing their innovative practices with other teachers, while new TAP teams can continue to form and be supported. A continuing challenge to the schools and the district office is in deciding how much innovation can be adequately supported with existing resources.

6. External Facilitation

The sixth major component of the Vanguard model is the interaction of teachers and others in a school community with experts outside of the DoDEA system. The need for external facilitation has been recognized in other research on systemic reform but is particularly important in DoDDS where teachers are more isolated than in the U.S. Vanguard is testing a wide range of mechanisms for achieving that external facilitation, including on-site workshops, individual consultations, for-credit online courses, and network-based communications. As is the case in all schools, the most challenging factor in this effort is in finding time for teachers to devote to learning and exchanging information (Watts & Castle, 1993).

Table 1. Key Characteristics of Aviano TAPs

TAP	**Subjects**	**Grades**	**SIP Benchmark***	**Technology Applications**	**Vanguard Strategies Linking Across:**
School/Home/ Community**	All	All	8.1	Database; e-mail; Internet	communit
Multimedia Productions	All, tech ed	9–12	10.8	Multimedia; video cameras	curriculum
Problem solving with GIS	All, tech ed	7–12	4.2; 8.1; 10.8	Geographic Info Sys; CAD	curriculum communit
One-Room Biology	Botany	6, 10	4.2; 10.8	E-mail; microscopes	curriculum cross-age
Writing Conference Partners	Writing	5, 7	3.1; 10.8	E-mail; World Wide Web	curriculum cross-age; DoDEA sc
Microcomputer-based Labs	Science	5–11	4.2; 10.8	MBL; e-mail	curriculum cross-age; DoDEA S
Radon	All, chem.	7–12	4.2; 8.1; 10.8	MBL; spreadsheets; GIS; radon detectors; World Wide Web	curriculum communit DoDEA sc
H S Electronic Portfolio	All	7–12	3.1; 10.8	World Wide Web; multimedia	curriculum
Presenting Yourself	All	4–6	3.1; 8.1; 10.8	Hypermedia; presentation tools	curriculum
Career Interests Elementary	All	3–6	4.2; 8.1; 10.8		curriculum communit
Elementary School Web Pages	All	3	3.1;8.1; 10.8	World Wide Web; digital cameras	curriculum communit
Project Based Learning Elementary	All	3–4	3.1; 4.2; 8.1; 10.8	Desktop publishing; video cameras and VCR; net projects	curriculum communit DoDEA sc
Text to Voice	All	All	3.1; 4.2; 10.8	Text to speech	curriculum
Student Authors	Writing, reading	pre-K–1	3.1; 8.1; 10.8	Desktop publishing	communit

*Benchmarks: 3.1 Increase student learning in reading, language arts, and social studies; 4.2 Narrow the racial, ethnic, and gender gap in math and science; 8.1 Implement and evaluate the effects of home-school partnership; 10.8 Establish use of electronic technology for instruction, resource management, and record keeping.

**The School/Home/Community team started as a TAP and was changed to a Capacity-Building Team.

7. Research Agenda

The seventh major component of the Vanguard model for innovation is the creation of an agenda for research on factors that affect the school system's ability to change in response to changing demands of a changing world. The work of the capacity-building teams and TAPs serves as a context for studying six key components of systemic educational reform. The six areas of the Vanguard research agenda include the following:

1. **Student roles.** Under what conditions do students play new and expanded roles, and what are the benefits to the students? Increasingly, teachers are finding ways to enable students to be teachers of other students, both within their own classrooms and in cross-age settings.

2. **Assessing student learning.** What methods and measures of student learning are feasible and useful for teachers and others to employ when evaluating innovative practices, and what support do teachers need in order to do this? This is the most challenging issue the schools face as they attempt diverse innovations, and some of the TAP teachers have made great progress in the past two years.

3. **Professional development**. What methods for job-embedded professional development help build the capacities of teachers for implementing new models of learning and what are the relative costs of those methods? Out of a dozen different approaches tested in Vanguard, the TAP process is by far the most powerful because it builds synergy among the people who work together daily. Other approaches to meeting individual needs through external resources in a timely way have been found to be challenging and costly.

4. **Technology integration.** What factors contribute to achieving student, teacher, and parent access to equipment, networks, and digital resources needed for effective educational activities? In DoDDS, schools do not have local technology plans or local control over acquisition of staff and equipment resources. Local authority over technology acquisition and management, in relation to priorities of the local SIP, are essential if technology is to be integrated effectively into education.

5. **School-home-base relationships.** Under what conditions do parents and other base personnel play

significant new roles in helping students learn? In the three elementary schools, teachers have created many opportunities for parents to play key roles in the instructional process. Parents are essential to the innovative practices in these classrooms, and they participate enthusiastically because of opportunities they have for experiencing the products of their children's work.

6. **Institutionalizing innovation processes**. What factors affect the school community's ability to initiate, implement, evaluate, and sustain worthwhile innovations? Turnover in administration, base personnel, and families poses great challenges to sustaining efforts that are initiated. Hence institutionalization through the SIP and sustained support for teacher teams is critical to making cumulative progress. Ability of teachers to assess student outcomes from their innovative work, and communicate those findings to other members of the community, is essential to obtaining the political support needed to sustain innovative efforts.

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Poster Session

Training That Makes Teachers Technology Evangelists

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A How-To Guide

Fort Worth School District's Instructional Technology Department can show you how to make your technology staff development so effective that participants will spread the word. Follow these three "I" Words: Incentives, Inventive, and Important.

Offer Incentives

Incentives can be big or small or even free. Our Technology Bootcamp, TECHS Seminar and Teacher Technologist Institute focus on teachers with specific skill levels, and all offer a classroom computer on completion of a minimum of 40 hours training. Our Take the Class—Get the Software sessions allow teachers to receive training and get software for immediate student use that was specifically selected to reinforce our district's goals. Teachers consider a class, such as Integrating the Texas Essential Knowledge and Skills (TEKS) for Technology into Your K–5 Curriculum, that is tailored to meet specific needs that must be addressed, vital without further incentive. The funds we receive from the Texas Technology Allotment for hardware, software, and staff development enhance the training incentives we can offer.

Be Inventive

Offering classes that use technology in unusual ways may be just the hook to reel in an otherwise reluctant teacher. Our series, Technology and Textiles, might encourage a participant to use technology in instruction as well. The series includes computer quilt design, how to make cloth books, and computer pattern customization. In T-Shirt Design and Print, teachers use a computer to create a design, then use our commercial press to put it onto a T-shirt. Mouse pads, refrigerator magnets, name badges, bound books, and much more can be computer-created and finished on our special equipment. Even our more conventional classes are focused on empowering students and teachers with technology, not just using technology.

Important Resource

Your trained teachers are important to your training network. Value and support them as they use technology. Almost all teachers we train are asked to contribute a technology-based lesson plan or a multimedia project that can be used district-wide. Some teachers contribute training for other teachers in trade for their specialized training. Every teacher who takes our training receives our newsletter, which highlights teachers using technology; provides technology tips; announces contests, grants, and conferences; and includes a training schedule. The next step of training is offered regularly for teachers at all skill levels. Teachers may take stand-alone training in everything from Scanners, Cameras, and Video Capture to Using Presentation Software. Teachers whose subjects have electronic textbook adoptions receive training in using the equipment and in teaching strategies that take advantage of the technology. We recognize exciting uses of technology in instruction with our annual Celebrate Teaching with Technology Teacher Awards Program. Categories are divided by grade level, and there are prize winners in each contest category as well as an overall winner.

Evangelistic Spirit. Ultimately teachers who take our training become advocates for Teaching with Technology.

Paper Session

Collaborative Educational Multimedia Design by Children: Do All Learners Benefit Equally?

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Key Words: multimedia, collaboration, animation, elementary school science

We present and discuss the results of a project in which seven teams of elementary school students were involved in designing and implementing interactive multimedia resources in science for younger children. We found that students improved significantly in their science understanding and programming skills. We discuss the benefits and problems of integrating science content with multimedia design and discuss why the quality of dynamic and interactive components in students' multimedia productions proved to be a better indicator of students' learning than the quantity of multimedia produced.

Introduction

In recent years there has been a surge of interest in the use of multimedia in educational computer applications. Developers have added sound, graphics, photographs, and video to applications that were previously dominated by text. Various research efforts investigate ways in which multimedia features, such as video (e.g., Cappo & Darling, 1996; Rubin, Bresnahan, & Ducas, 1996), graphics (Rieber, 1994), or combinations of features (e.g., Jackson et al., in press), can contribute to students' learning. One underlying premise of most research is that providing students with multiple representational formats in a content domain helps to build their understanding and addresses the diversity found in students' learning and thinking approaches.

While these multimedia features potentially add value to applications, less attention has been given to approaches that provide learners with the opportunity to design and program their own multimedia software applications. To take a closer look at the potential of multimedia design for learning, we examined the cases of seven design teams that were involved in creating interactive multimedia resources about astronomy. During a period of three months, a class of elementary school students (Grades 5 and 6) was divided into teams that met regularly to program multimedia applications for younger students in their school. Previous research documented the learning benefits for programming and content matter for students (Harel, 1991; Kafai, 1995). In this article, we focus on the final multimedia artifacts created by the students. We examine various program functions and the multimedia content of the final software products. Furthermore, we investigate how the team products themselves reflect the contributions of their individual authors. The purpose of these analyses was to illuminate some of the knowledge that young students have about multimedia design—as expressed in their products and in their interface design—and in which ways designing multimedia afforded learning opportunities for them. Insights gained from these analyses will contribute to the design of multimedia tools and environments in which young designers create software for their own learning.

Theoretical Background

Learning through designing multimedia applications is part of a larger effort to provide children with rich learning experiences (Brown, 1992). It proposes software design as a new model of integrating programming with other learning that goes beyond learning programming for its own sake (Harel & Papert, 1991). Software design requires more than just the mere production of programming code: students have to consider interface design issues, deal with content aspects, and create, debug, and maintain their programs. Learning programming is consequently situated within a larger learning context and integrated with other subject matters. In designing their own applications, students reformulate their knowledge by creating and implementing external representations in their software. Multimedia features of software can facilitate this process, as they allow students to use and combine various representational formats in one medium.

While knowledge reformulation is an important feature of learning through software design, personal expression of one's ideas is another. With the increasing proliferation of commercial education and entertainment software, students have become accustomed to a software production level that makes extensive use of multimedia features. While students might have a wealth of experience in using multimedia applications, they have little knowledge about making multimedia software. Creating multimedia applications is a complicated and collaborative enterprise. In research and commercial contexts, groups of professional designers, programmers, and content specialists work together for several months (Lammers, 1986). Several studies have used this approach to study the thinking and learning of young software designers (Blumenfeld et al., 1991). One series of projects focused on children designing instructional software for mathematics (e.g., Harel, 1991; Kafai & Harel, 1991) and instructional games in science and mathematics (e.g., Kafai, 1995; Kafai & Yarnall, 1996). While these studies made special use of programming as a vehicle to foster children's learning of content, other studies used platforms such as hypermedia and authoring environments (e.g., Lehrer, 1991; Carver, 1991; Spoehr, 1995). In all of these studies, the researchers reported significant learning results. In this particular study, we decided to focus on the nature of the applications created by the students. We used the final computational artifacts as a starting point for investigating what kind of learning opportunities in science and programming was afforded by the design of an interactive multimedia resource and how this was related to individual students' contribution to the multimedia product.

Research Context and Participants

The project took place in an urban elementary school that functions as the laboratory school site for University of California—Los Angeles. The participating classroom was equipped with seven computers; each was set up as a workstation for the seven table clusters. An additional seven computers were in an adjacent room and were mostly used for related Internet searches.

An integrated class of 26 fifth- and sixth-grade students participated in this project. There were 10 girls and 16 boys of mixed ethnic background (19 Caucasian; 2 Hispanic; 3 African-American; 2 Asian) ranging between 10 and 12 years of age. Students were grouped in seven teams according to the following criteria: one "experienced" designer (who had participated in the previous design project), mixed gender, and different academic success levels. One week before the start of the project, students were given an introduction to the main features of the MicroWorlds Logo programming environment. The assignment was to build an interactive multimedia resource about astronomy for younger students. Students worked 3–4 hours per week on the project for a period of three months, spending 46 hours in total of which 23 hours were dedicated to programming. Science instruction and programming time were combined.

We collected data from a variety of sources: fieldnotes and videotaping of students' interactions, students' notebook entries about work assignments and distribution, daily logfiles of the software, interviews with team members, and pre- and posttests assessing students' science and programming knowledge and their views on collaboration and project management. For this paper, we concentrate on the final software products, which were analyzed regarding the nature of their functions and the contributions of individual team members. The main data comes from a classroom activity conducted toward the end of the project in which each team met and determined which individuals should take credit for which parts of the final product (e.g., text, graphics, and animations). The following analyses focus on the screens that constituted the interactive multimedia resource about astronomy.

Results

All seven teams finished a multimedia information resource at the end of the project. Our project observations documented that the completion process was not an easy one. For one, students had considerable problems in the beginning sharing work and computer resources, as each team consisted of three to four students each, but only one computer was available to all the team members. Furthermore, many students were learning Logo programming as they were designing their multimedia resource. While this provided an authentic context for students' learning, it also limited students' expression in the beginning to simple page designs. Later on, students started including animations of the life cycle of stars or the planet movements for lunar and solar eclipses. As for its science inquiries, each team posed several questions, such as "Is there life on Mars?" or "What do we know about Black Holes?" which they intended to follow up in their science research. As the project progressed, these questions changed in focus and range. Some students reformulated their questions, while others added new ones that usually were more specific, such as "What is the Big Bang?"

Students' Learning of Science and Multimedia Programming. In terms of the effectiveness of the overall intervention, we found that the design project was successful as a vehicle for both science learning and Logo programming development. To assess students' improvement in their knowledge of science content, we administered pre- and posttests in astronomy. Our preliminary analysis showed significant differences for the pre- and posttests in students' understanding of astronomy (Pretest: 31.5, Posttest: 37.2, df 25, t: 5.65, $p < 0.05$). Students' understanding of Logo also improved (Pretest: 13.3, Posttest: 18.6, df 24, t: 4.38, $p < 0.05$). In addition, in terms of programming skills, many students started out at ground zero, knowing no Logo at all. These results are strong indicators of individual students' improvement in science and programming. We also see the importance of understanding what kind of products students designed, thus we analyzed first the team efforts and then how students' individual contributions to this effort were structured.

Evaluation of Educational Multimedia Software: Team Contributions. Each interactive multimedia resource consisted of a set of interrelated screen pages that were linked together with the help of buttons or clickable objects that could be activated through a mouseclick. Some of the screens had combined media elements, such as text and graphics, while others worked only in one medium, text or graphics. The number of created screen pages differed considerably for each multimedia design team; yet this was not a good measure of production value because screens differed in their functionality. We defined three categories of screens: content screens, quiz/feedback screens, and information/navigational screens. Table 1 provides an overview of the distribution of the different screen functions.

Table 1. Distribution of Screen Page Functions

	CON	AN	IN	QU
Team 1	17	2	4	6
Team 2	15	3	3	11
Team 3	9	2	3	-
Team 4	12	1	6	13
Team 5	14	2	2	12
Team 6	23	1	6	18
Team 7	11	0	2	31

KEY: CON = content screens; AN = animations;

IN = information/navigation; QU = quiz/feedback

Content screens represent some piece of knowledge about the field of astronomy. They can take the form of text, pasted pictures, drawings, or any combination of those three design elements. The larger category of content screens was also broken down further to specify content animation screens. Content animation screens (CA) contain animations or simulations that exemplified dynamic aspects of the solar system, such as the lunar eclipse, the life cycle of a star, or the effects of gravity. Only in one instance was the player given the possibility to set the parameters for a game-like animation (team 3).

Many groups in the project decided to include Quiz/feedback screens to complement their multimedia resource. Quizzes usually asked questions about the content displayed elsewhere in the product but occasionally introduced new material. Most quiz screens contained one or two multiple-choice questions with buttons linking the user to feedback on his or her response. Feedback screens consisted primarily of simple pages exclaiming “right!” or “wrong!” in a very large font. Only in a few instances were users provided with additional information, as in the question “Can Martians Dance: Yes or No?” The answer page in either case replied “There is no right or wrong answer to this question, because we don’t know if there are Martians on other planets” (team 6).

Another type of screen common to most group products was Information/navigational screens that provided information about the designers themselves or displayed the title of the software and subtitles of topic areas, such as, “This is the Planets Section!” Other screens contained buttons or turtles that linked to different topic areas and provided information to the user on how to navigate the software, such as a table of contents. The graphical arrangements on these pages differed considerably. While in a few instances students took advantage of a graphical representation of the solar system as an entrance to different planets, many others just placed a variety of buttons on the page.

To summarize the design efforts by the teams, we see that students made extensive use of multimedia. A pervasive feature of all software applications is that students tried hard to emulate commercial software models. A comprehensive analysis of all seven final versions of the educational multimedia resource showed that all of them used "point-and-click" as their main mode of advancing through the program. They provided menu options, had navigational features, such as title screens, introductions, content overviews, and final screen and credit messages. In the instructional component, students (with the exception of one team) provided limited positive and negative feedback and sometimes explanations. But students' software did not provide the player with a "Quit" option, a feature that either many designers did not have time to implement or did not consider important. Furthermore, "Help" options were absent as well. Being beginning interface designers, the students were able only in a limited way to foresee their users' needs.

Evaluation of Educational Multimedia Software: Individual Contributions. While all students contributed to the final versions of their software, the levels of individual effort among the students in any group needed further examination. We decided to use the final artifacts themselves not only to document effort and equity but also to examine the ways in which individual contributions to each group's final product have different affordances for product appearance, individual credit-taking, and learning benefits. To create a score commensurate with students' experience, we created a "design differentiated score" by looking at the types of screens created by individuals in the context of their total contribution. For that purpose, we used the three types of screens defined above, content screens, quiz/feedback screens, and information/navigational screens. Student differentiated scores for each type of screen were created using the same values as the raw scores. To create design-differentiated-screen-type scores for each student, we added up all their points for each category of screen. Thus, a student with a raw score of eight screens might have four content, three quiz/feedback, and one information/navigational screens.

After examining the differentiated scores (see Table 2), it appeared that they explained much of the deviation from expectations that showed up in the objective scores. Looking at screen types seemed to be a much more viable measure of participation than total screens. Students who created the most content screens and content animations were the ones who displayed the most leadership, spent the most time at the computer, and showed the most developing astronomy knowledge. In the group products for which the student with the most total screens was not the same as the most dominant and knowledgeable student, we saw that the one with the highest raw score created mostly quiz/feedback and information/navigational screens. This finding is interesting not only because it lends support for measuring individual performance and contribution by some deeper means than merely counting the number of pages created, but it also provides a window into which types of screens are valuable for what purposes. In the following section, we discuss how the different screen types afforded different modes of thinking and learning benefits, and served different personal goals.

Table 2. Distribution of "Design Differentiated Scores"

	CON	**AN**	**IN**	**QU**
Team 1	10 2.5 2.5 2	1 - - 1	.75 .25 2.25 .75	2 - 4 -
Team 2	1.25 6.75 4.25 2.75	1.5 .5 1 0	1 - - 2	5.5 1.5 0 4
Team 3	3 1 5	- 1.5 .5	2 1 -	- - -
Team 4	3 4 3 2	1 - - -	6 - - -	- - - 13
Team 5	3.33 3 4.83 2.83	1 1 - -	.25 .25 1.25 .25	- 2 10 -
Team 6	4.5 13.5 2.5 2.5	1 - - -	2.5 1 1.5 1	0 10 8 0
Team 7	2 8 2	- - -	1.5 .5 -	5 14 12

KEY: CON = content screens; AN = animations;

IN = information/navigation; QU = quiz/feedback

Discussion

Learning through designing multimedia applications provided a fruitful avenue for students to build their astronomy and programming knowledge as they worked together in teams.

Learning Affordances of Different Multimedia Resource Functions. Working on different multimedia functions served different goals for the designers, in both science content and multimedia learning. While informational/navigational screens presenting tables of contents, title pages, or personal information about the designers may not necessarily contain science content, they have definite value in terms of technological fluency. Making tables of contents, main title pages, and topic area title pages requires taking the perspective of the user and considering what he or she would find most helpful in navigating the software. Navigational screens are not by nature devoid of content, as illustrated by the comparison of the solar system model title page and buttons title page shown earlier, but many of the information/navigation pages designed by students in this study had little or no content. The process of making such pages is relatively easy, because no animations are required, no astronomy research is required, and little programming is necessary other than linking buttons.

Quiz/feedback pages afford several benefits from a software design perspective. For one thing, the type of drill-and-practice quiz designed by most groups is a "quick and dirty" way to add interactivity to the software. In fact, when asked by researchers why they were making a quiz, the students often responded that it was because the users would want more interactive features. Making a quiz takes relatively little time, when all that is required is a series of questions with buttons leading to pages that say "right" or "wrong." Another benefit is thus that students who felt that their contribution was too small were able to increase the number of pages they created by adding a quiz on some topic at the last minute. From a science learning perspective, making quizzes does not allow the designer to experience the maximum benefits of the software creation process. Most quizzes in this project were a disjointed set of questions with little or no relation to one another, followed by feedback pages that gave no explanations of the correct answer. The process of designing a quiz, such as the ones we saw, may not help the designer develop systemic understanding in science, because a quiz only requires that he or she know the right answers to a series of unconnected science facts.

Content/animation screens are the most difficult to create, but they also afford the most learning benefits, both in terms of technological fluency and systemic understanding. Even the most basic kind of content page, one with only text and/or pictures, requires deeper levels of thinking about astronomy than the disjointed kind of knowledge represented by a quiz. Because students had to think about their users, 3rd and 4th graders, they had to write all the text sections in their own words and explain astronomy phenomena in language that younger students would understand. This consideration discouraged such practices as cutting and pasting of text from the Internet or copying word-for-word from books. Opportunities for even deeper thinking about users, programming, and the subject matter are afforded by more elaborate content pages, which use animation to depict some astronomy phenomenon. Creating animations requires the designers to learn Logo beyond relying on the basic point-and-click controls of the MicroWorlds system because they have to direct the turtle in complex patterns and series. Most importantly, animations afford remarkable growth in systemic understanding. They require the designer to comprehend something well enough to create a model of the whole phenomena, as opposed to merely possessing a descriptive understanding of "what happens."

Integration of Multimedia Development Within Science Learning. From the preceding analysis and discussion, it is clear that instructional multimedia development is a challenging enterprise for young software designers (as it is also, incidentally, for most professionals). Students had to deal concurrently with learning about astronomy and learning about multimedia software design and all its components (i.e., code writing, debugging, and maintenance). One could argue that the concurrent learning requirements might have hindered more than helped students. On the other hand, while schools traditionally introduce these subjects sequentially, we see a special synergy in learning them together at the same time. For one, it is difficult to imagine a course about multimedia design without students being engaged in designing media about something. Design has to be situated within a particular context or domain, so that designers as well as users can judge the value of their implementations. Furthermore, situated multimedia design provides an opportunity for the learners/designers to approach subject matter from a different vantage point than their own. Instructional design, as implemented in this project, affords particular learning possibilities not only for the designated user of the instructional material but also for the instructional designer. We found that interactive and dynamic aspects of screen designs provided a good indicator for learning that integrated the programming and science. The development of instructional animations facilitated students' better understanding of systematic aspects of science while it led them at the same time into more sophisticated programming and vice versa.

Students' Conceptions of Users. Designing the multimedia application provided students' with some valuable lessons in interface design. Students' experience as multimedia consumers did not necessarily lead them to factor in the user's perspective into their designs. We found that students had difficulties assessing user needs or problems. Some comments made by the users at the end of the evaluation session also indicated the difference of perspective: while the designers were focused on providing a fun experience and getting through their demos, the users were distracted by the large number of spelling mistakes they found on the content pages. Some users commented on the graphics (often repurposed from Internet pages), which they liked but found "blurry"; one user added that this gave graphics a more realistic touch, referring most likely to the idea that pictures taken from hundred thousands of miles away cannot be precise. A general complaint by the users was that the software content was new for them. They suggested that the designers should create different entrance levels, or, as one user said, "I would have buttons like beginner, intermediate, and expert." Another suggestion was to stay within the more specific space theme and to use labels such as "expert astronaut," "in training," and "ground control."

Conclusions

Designing multimedia software presented students with complex issues, some of which became evident in the previous discussions. Students needed to coordinate multiple demands in designing and implementing their work. Based on our observations and analyses, we found that elementary students' experiences and associated conceptions do not adequately prepare them for managing long-term, less well-defined design projects, which require more flexibility and iterative planning strategies. Furthermore, we found that students need more support in their collaborative work if the design situation is to be an effective learning context for each individual team member. It is obvious that the transition from a multimedia consumer to a multimedia producer is not an easy one. Yet the potential benefits make it a worthwhile learning experience.

Acknowledgments

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Spotlight Session

DesignWorlds for Learning: Virtual Collaborative Creativity

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Key Words: multimedia, World Wide Web, collaboration, design, virtual communities, creativity, project-based learning

> *"Whereas traditional media offer content, the Internet requires you to build content from the huge resources it puts at your disposal."*
>
> *Paul Gilster, (1997)*

DesignWorlds for Learning, Inc., was founded in 1997 by Ted and Frona Kahn to use technology and support the development of new kinds of creative and collaborative services and online products for lifelong learning communities. DesignWorlds focuses on using computers and the Internet as a means of expanding the diverse, creative talents and resources of students, teachers, and schools through collaborations with others in building shared learning resources that provide value to *all* of the participants in a learning community. It promotes a model of learning in which all participants in a learning community become learners, providers, payers, and policymakers (see Institute for the New California, 1997). In this way, the Internet is a new medium for participation in knowledge and value creation through the formation of communities, not just a rich information and content delivery resource (Gilster, 1997; Hagel, 1997; Kahn, 1997). Higher levels of student learning are achieved through leveraging collective know-how, diverse technology resources, and creative talents of participants to design new interactive and exploratory environments and knowledge resources for learning communities (Kahn, 1997; Kalil, 1997)

This panel will present a sample of the student projects being developed by Multimedia Makers (Kahn & Ullah, 1996; Mestel, 1996), the first active DesignWorlds for Learning community. This project was originated by the Institute for Research on Learning (IRL) and BAMTA, a public-private alliance for accelerating growth of networked multimedia technology and applications. Through initial high-bandwidth support from the California Research and Education Network Trust (CalREN), use of Creative Partner (donated by emotion, Inc.), a powerful client-server multimedia content management and distribution system, and a variety of multimedia, video, and Web authoring/creation/editing tools, the four core Multimedia Makers schools in the Oak Grove School District in San Jose have been helping to create a global "virtual design studio" to support distributed, collaborative student development of educational multimedia and Web-based learning resources.

Linda Ullah is a GATE Resource Teacher at Edenvale School and a technology learning coordinator for the Blossom Valley Learning Consortium (BVLC) of the Challenge 2000 Multimedia Project in San Jose, California. Edenvale's GATE students have been participating in the Multimedia Makers project since its inception. This year's projects include:

- Mars Virtual Olympics, a thematically planned collaboration between Edenvale GATE students and Herman Intermediate School eighth-grade science students to create an Internet-based Mars Virtual Olympics (http://www/davis.ogsd.k12.ca.us/s/edenvale/mars1/olympics.html). This links a number of NASA Mars online/CD-ROM resources with the recent U.S. Olympics PBS CyberSchool powered by IBM project (http://www.ibm.pbscyberschool.org/).

- Water Pollution in Brazil and California, a collaborative interdisciplinary research and arts project between the Edenvale students and several high school classes at EEPSG Idalina Macedo Costra Sodre, a high school in Sao Paulo, Brazil. This project was a result of the ASTL International Educational Workshop in Israel in November, 1997 (http://www.teleproj.com/). Students at the two schools are creating a joint Web site at http://www.garlic.com/~lullah/brazilus/water.html; it's used to share research, solutions, and discusses the effect of art and literature on the environment and to create a political force that will give our students a real voice in cleaning up our watersheds for ourselves and for future generations.

Barbara Rawson is an eighth-grade science teacher at Herman Intermediate School and BVLC in San Jose. Both she and Linda Ullah have also been active in workshops at the Digital Clubhouse Network, an innovative approach to creating learning communities around digital video storytelling. Barbara has worked with many middle school students in designing future space colonies on Mars, and this year she participated in having her students design interactive multimedia and Web activities around the physics of sports in conjunction with the Winter Olympic Games in Nagano. She also beta-tested NASA's Mars Virtual Explorer CD-ROM and multimedia curriculum project (http://www.garlic.com/~lullah/bvlc/2kmm.html).

Ted M. Kahn is the project director of Multimedia Makers and president/co-founder of DesignWorlds. He is also a senior fellow at the UCLA Graduate School of Education and Information Studies and an affiliate of the Institute for Research on Learning (IRL) in Menlo Park, California. He will give an overview of this project from the perspective of *Learn & Live* (GLEF, 1997) and other views of the future of learning and work in the 21st century.

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General Session: Curriculum Design/Strategies

SimCalc: Democratizing Access to Ideas Underlying Calculus Beginning in Middle Grades and Earlier

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Key Words: mathematics, calculus, mathematics of change and variation

We will describe and demonstrate innovations in technology and curriculum that enables mainstream students from late elementary school onward, especially in urban schools, to learn the basic ideas underlying calculus and, more broadly, the mathematics of change and variation (MCV). Curricular innovations rethink the core mathematics curriculum in terms of key ideas such as connections between variable rates and accumulations, averages of variable rates, and approximations, in ways that allow students to exploit basic arithmetic and geometry understandings in combination with intuitive knowledge of motion and change, thus reaching understandings that previously required long algebraic prerequisites reserved for the privileged elite who would take formal calculus courses.

Of special interest are five technological innovations: (1) visually editable graphs that control simulations, particularly graphs of piecewise-defined functions, (2) hot linked connections between rate data and accumulation data, (3) visualization and analytic tools intended to make change visible and controllable, (4) two-way data transfer between physical and cybernetic (simulation) realms, and (5) scalability of software across computers and hand-held devices. Innovation (1) allows students to compute integrals of nonconstant rate functions (e.g., velocities) using only whole-number arithmetic without worrying about issues such as limits, continuity, and other complications, and to make rapid cycles of revision and comparison. Innovation (2) puts the connection between rates and totals at the center of attention, a connection that lies at the heart of the MCV—indeed, the formal version of this connection is called the Fundamental Theorem of Calculus. Innovation (3) involves discretizing continuous phenomena by stepping through simulations at specifiable time intervals, leaving traces that support measurement and analysis. Innovation (4) enables students to create physical motions (body-motion or moving objects) and attach these to objects in a motion simulation, or to create functions and use these to drive physical phenomena, such as the motion of toy cars. Innovation (5), in its early stages, involves integrating computer and hand-helds, especially graphing calculators (by far the most widely used computational devices in mathematics classes), in classroom networks with a single computer and classroom display networked to student hand-helds.

The suite of technological innovations is accompanied by a series of curricular innovations that use basic MCV modeling and simulation activities to organize, contextualize, and enliven core mathematics ideas, such as rates, proportions, slope, areas of geometric figures, signed numbers, and fractions, as well as more advanced ideas involving functions and actions on functions across representations, including algebra. The technological and curricular materials are being tested in a variety of school and university contexts from Grades 3–13, as well as in preservice and inservice teacher education. Results are exciting—we now know that mainstream students and teachers can learn the fundamental ideas underlying calculus without passing through the long gauntlet of algebraic prerequisites. The major challenges are technological, in creating robust, affordable classroom networks that effectively integrate computers and hand-helds, and curricular, in integrating the big MCV ideas with a curriculum and associated expectations that have little place for new ideas, no matter how powerful.

Internet Poster Session

The Web as a Resource for Producing Quality Performance Assessments

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Key Words: World Wide Web, assessment, performance assessment

Overview of Web Resource

Performance Assessment: http://tiger.coe.missouri.edu/~rpdc/pa/index.html

In the state of Missouri, development is currently underway to construct statewide performance assessments related to the newly released state Show-Me Standards. Largely because of this, there is a great deal of teacher interest in the performance assessment model just as there is elsewhere in the country. There is a high demand for assessments that require students to use higher order thinking skills while executing a task within an authentic context.

For this Internet poster session, attendees will have an opportunity to explore a resource designed to provide support to educators struggling with the implementation of performance assessment strategies in their classrooms. This site, supported by the University of Missouri Assessment Resource Center and Regional Professional Development Center, is specifically designed for Missouri educators but is valuable for educators in any state.

A major component of this site is the searchable database of performance assessments. More than 100 exemplar assessments are currently available for a wide variety of levels and content areas. This growing database is made available without restriction to Internet users and includes submissions from national, state, and district levels. A user cannot only obtain descriptive information but may also download the assessment in PDF format. While these exemplar assessments may be helpful in the classroom, they primarily serve as models for original teacher-constructed assessments.

A second component of this site is devoted to resources related to professional development in performance assessment. While the state is moving ahead with large-scale assessments, many teachers are interested in improving their ability to produce assessments for their classrooms. The database will be most effectively used by those educators with a background in performance assessment. Because of this, resources are provided to assist educators develop an effective approach to assessment that is linked to teaching and learning. This component is not designed to provide professional development but rather to provide resources that will be useful in this area. For example, users will find a rubric constructed on the design of performance tasks.

While this site targets Missouri educators, it may prove useful for classroom teachers in other states or serve as a model for those interested in professional development.

General Session: Curriculum Design/Strategies

An Overview of the National Education Supercomputer Project at Lawrence Livermore National Laboratory

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Key Words: simulations, science, K–12, climate, pollution, interactive, cross-curriculum

This session is an exploration of an interactive Web project that will enable your students to utilize powerful scientific simulations including climate modeling and dispersion of atmospheric pollutants. The National Education Supercomputer Project at Lawrence Livermore National Laboratory offers access to a Cray Supercomputer to K–12 students via the Internet (http://nebbs.llnl.gov/). Currently, students can utilize the power of supercomputing to create various science simulations—climate modeling, 3-D ray-tracing models, fractal geometry, molecular modeling (in beta), and materials analysis (also in beta). This project has had an on-going presence on the Internet since 1991.

The session will also review the newly developed AIR project—atmospheric interactive research—(http://air.llnl.gov/). To quote from the AIR info Web page:

> *The atmospheric interactive research (AIR) pages are made available to the educational community by the Lawrence Livermore National Laboratory's (LLNL) Education Program in conjunction with the Atmospheric Release Advisory Capability (ARAC). These pages are intended for K–12 educators and students to provide a resource for the exploration of atmospheric dispersion. By using dispersion simulations students can explore many difficult concepts associated with physics, earth science, biology, and chemistry. Discussions of the consequences of dispersed substances can lead to a greater understanding of the associated ethical, social, and historical issues.*

The AIR/ARAC pages include hands-on classroom projects, Web-based simulations that illustrate the dispersal of atmospheric substances, lesson plans, and real-world graphic simulations of atmospheric substance releases from Chernobyl, Kuwait, and other sites.

Handouts

Handouts and support materials will be made available at the session or by request to the presenter via e-mail at (rking@telis.org).

http://members.aol.com/robhking/ETO/index.html.
WWII/European Theater of Operations.

http://www.eusd.stan-co.k12.ca.us/empire/empmenu.htm.
Empire Elementary home page.

I never did, I never did, I never did like "Now take care, dear!"
I never did, I never did, I never did want "Hold-my-hand";
I never did, I never did, I never did think much of "Not up there dear!"
It's no good saying it. They don't understand.
"'INDEPENDENCE' from 'when we were very young"
A. A. Milne

Workshop

Professional Development Planning: Can You Succeed Without It?

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Key Words: professional/staff development, technology competencies, performance outcomes, professional accountability

Summary

Professional/staff development strategies for successful 21st-century learning environments must be efficient, effective, and economical. Efficiency is measured in terms of maximum time on task and minimum time away from the individual's routine environment. Effectiveness is measured by the attainment of desired outcomes for each individual served. Economic viability is measured in terms of the ability to provide learning opportunities for the majority of audiences with available funding resources.

To achieve all three of these criteria, school districts require thoughtfully designed staff development plans addressing the developmental needs and learning styles of all learners (administrators, educators, support staff, and clerical personnel). Few school districts across the nation use their professional development resources to their maximum potential.

A comprehensive staff development planning process investigates and addresses the following variables:

- professional and performance expectations
- incentives and compensation
- learning alternatives and opportunities
- performance assessments
- accountability models

Each participant in this workshop will leave with an understanding of the

interdependence of these factors and the ability to assess each within an organization to develop a comprehensive professional/staff development plan for an entire district. During the workshop we will collectively create a “model” plan with hypothetical/sample data from all participants.

Discussion regarding professional and performance expectations will focus on teacher contracts; district, state, and national certification/standards; preservice certification requirements (NCATE); and professional organization standards (ISTE).

Time spent reviewing the topic of incentives and compensation will look at the diverse array of options that can be offered to individuals within the school community. Although many districts opt for a one-size-fits-all approach when compensating educators, a selection of multiple incentives and rewards accommodating the many life stages of individuals within the district is generally more appropriate.

Most school districts rely heavily upon course work and workshops to meet the technology-related professional development needs of educators. The discussion of learning alternatives and opportunities investigates and offers a diverse selection of strategies from which each individual can customize their own individual professional development plan based upon current ability and desired outcomes. The use of technology to attain desired outcomes will be emphasized.

Currently the performance of most teachers is evaluated through cyclical observations by school administrators (principals, assistant principals, and/or department heads). The overview of performance assessments will offer a host of strategies available for teachers to demonstrate attainment of desired outcomes and/or competencies.

If desired outcomes and/or competencies are identified and attained, how will they translate into better teaching, learning, and management within the classroom environment and school community? Accountability models and strategies based upon improved student outcomes will be considered.

Successful professional/staff development plans articulate a process for defining clear expectations for all staff, identifying appropriate compensation and incentives, offering a diverse array of delivery models and support, evaluating the attainment of outcomes/competencies, and determining the effectiveness of these strategies on student learning.

Participants in this session engage in active, student-directed, collaborative learning as we address the many topics related to successful professional/staff development planning.

General Session: Exhibitor Session/Emerging Technologies

Harnessing the Power of the Internet With HyperStudio

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Key Words: HyperStudio, multimedia, Internet, hypermedia, authoring, software

The Internet, as a resource, grows larger every day. With an "almost infinitely flexible choice of media: audio, video, text, or someday even 3-D graphics" (Sterling, 1995), the resources of the Internet are better suited to multimedia authoring than they are to text-only authoring. With Internet browsers such as Netscape, and multimedia authoring systems such as HyperStudio, students now have the ability to present research utilizing all the information, in any media, the world has to offer them.

This session will demonstrate how to harness the power of the Internet using HyperStudio. Students can link their multimedia projects to the latest resources on the Internet, as easily as playing a sound in HyperStudio, by using the NetPage NBA. Also, using the HyperStudio Plug-in for Netscape Navigator or Internet Explorer and the Export Web Page Extra, students can publish their multimedia projects on the Word Wide Web. These HyperStudio functions are available at the Roger Wagner Publishing Web site, www.hyperstudio.com.

Sample student projects will be shown that utilize the Internet to add depth to the research. Sample Web pages using HyperStudio Plug-in will also be shown. The Web site of Anoka-Hennepin ISD in Minnesota will be highlighted (http://www.anoka.k12.mn.us/HyperStudio/) for its resources on publishing HyperStudio projects on the Web. In addition, techniques for minimizing project size for transfer on the Internet will be discussed.

Reference

Sterling, W. (1995). Hype, hope, and the information highway: Limited-access tollways or multiple-access freeways? *Computer Learning*.

Workshop

Secrets for Success: Advanced HyperStudio Techniques

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Key Words: HyperStudio, multimedia, hypermedia, authoring, software

HyperStudio is being used by millions of students around the world not only because of its incredible ease of use but also because of the depth of features it offers. If you know the basics but are looking for more, this workshop will give you a chance to learn new techniques and capabilities. Attendees will learn how HyperStudio can be the thread that ties together all the resources available to them to create dazzling multimedia projects.

Attendees will learn advanced techniques involving:

- manipulation of the paint tools
- use of the graphic-effects editing tools
- creation and use of multiple animations
- use of New Button Actions to add impact to presentations

Based on the time available we will also discuss:

- digitizing and manipulating still and video images
- accessing resources from CD-ROM
- use of the Internet as a resource for projects
- using and creating QuickTimeVR movies

This session will end with some sample projects and a discussion of the effectiveness of a variety of media in authoring projects.

Paper Session

Engineering Undergraduate Distance Learning Programs: An Assessment

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Key Words: engineering distance learning, distance learning collaboration, accreditation, distance learning technology, quality of learning

Abstract

This particular research/survey of undergraduate engineering distance learning universities was conducted utilizing traditional and virtual sources of information. Various university Web sites were visited. Where information was scarce and/or needed verification, library resources were consulted. The study provided an overview of how distance education is being practiced in universities worldwide, with particular attention to universities in North America. Technologies for access and interactivity, quality of learning, and accreditation are discussed.

Introduction

Distance education reverses the traditional way of providing education to the learning community. Instead of students coming to the university to get that needed education, the university instead comes to the student. Differing thoughts and issues about distance learning abound.

> *Distance education is a movement that sought not to challenge or change the structure of higher learning but a movement to extend the traditional university, a movement to overcome its inherent problems of scarcity and exclusivity. (Hall, 1996)*
>
> *The percentage of 25–34-year-olds enrolled as college undergraduates increased by 33% and in the even shorter period between 1976–1994 the percentage of undergraduates age 35 and older also increased by 33% (Occupational Outlook Quarterly, 1996). This older*

> *population, engorged by the baby boomer bubble and the need to train and retrain a workforce to deal with the rapidly changing workplace requirements altogether create a big market for the delivery of postsecondary education through distance learning. (Goldstein, 1991)*
>
> *Information technology and network developments appear to push us in two seemingly opposite directions: In the one case, toward a more open, unbounded (and unregulated) enterprise; in the other toward more collaboration and partnering.*
>
> *Distance education has itself suffered from shortcomings and scarcities that have made it difficult to operate, expensive to develop, and occasionally difficult to validate. (Hall, 1995)*
>
> *Distance education will be commonplace in the future. (Educom Review, 1997)*

While 40% of competitive improvements are derived from direct investments, 60% of competitive advantage comes from advances in knowledge or innovation (Carnevale, 1992). Innovation complements science and invention with constant improvements (Carnevale, 1992). A lot of modern conveniences, such as the automobile, and progress in industry, e.g., in the telecommunications industry, are products of continuous innovation that is happening in the field of science/technology and engineering.

The rapidly changing field of engineering makes engineers critically dependent on keeping abreast with new developments (Moore & Kearsley, 1996). Innovation can happen when the workforce is in a constant cycle of learning, relearning, and cumulative learning. Adult education provides an opportunity for those employed to keep pace with rapid changes in the workplace. Participation rates indicate the importance of lifelong learning as a condition of employment in the future labor force. In 1995, 21% of all adults participated in work-related adult education. The majority comprising this percentage took courses provided by businesses or professional organizations. Others were provided by colleges and universities or government agencies. Workers in the executive, professional, and technical occupations were most likely to receive on-the-job training. Distance education is able to address this critical learning need in the field of science and engineering.

Distance Learning Cooperative Movements in Engineering Higher Education

The latter half of the 1980s and the early 1990s saw the emergence of many distance learning consortia based on satellite television and the large industry of "business TV" delivered by satellite (Moore & Kearsley, 1996). Two advantages that are attributed to consortia-delivered distance education are its capability to offer a broad selection of courses and the strong competition that exists among the member universities in terms of offering the best-quality courses in the most timely manner. The customer's (students, employees, companies) needs dictate what courses are in demand and marketable (Moore & Kearsley, 1996). In this paper, four engineering distance education consortia partnerships are discussed.

The National Technological University (NTU)

Established in 1985 and based in Fort Collins, Colorado, the accredited National Technological University (NTU) is a cooperative effort of 47 universities (Table 1) providing for graduate and continuing education for the busy engineer, technical professional, and manager. NTU has no faculty or campus of its own but relies on courses taught by faculty of participating teaching universities. Through satellite communication and compressed digital video, these universities are linked together and relayed to more than 1,000 work locations internationally. With internal connections to other regional networks these universities are linked to 350 sites in North America. Courses are uplinked to NTU by satellite from the originating university and then NTU redistributes these courses to the various sites by satellite. By means of instructional television, engineers, scientists, and managers at their job sites can tune in to technical and managerial courses offered by top faculty and experts at the nation's leading engineering schools and other organizations and institutions selected because of their special expertise. During 1996–97 these practicing professionals chose from more than 500 academic courses providing 22,000 hours of instruction, plus another 500 days, or 3,000 hours, of continuing education. Enrollment during the 1996–97 school year was 110,000, with 1,300 working professionals and managers.

The National Universities Degree Consortium (NUDC)

The National Universities Degree Consortium (NUDC) (Table 1) is a consortium of 13 accredited universities across the United States working together to offer more than 1,000 courses, three credit certificates, 11 bachelor degrees, and 24 graduate degrees through distance education. Through the NUDC each individual member of the consortium offers courses through a variety of distance education formats. A few of the institutions offer external degree-completion programs. Students can choose from a wide variety of coursework offered by all the members to complete the degree program of a particular institution. Member institutions develop and manage the operations of the consortium and ensure high-quality programs with the ultimate goal of providing university credit courses leading toward external degrees. Engineering programs are at the master's level and are offered in three of the consortium member universities: Colorado State University, University of Idaho, and University of Alabama. Colorado State University is a member institution of both NTU and NUDC.

Southeastern University and College Coalition for Engineering Education (SUCCEED)

Funded by the National Science Foundation with matching funding provided by participating institutions, the Southeastern University and College Coalition for Engineering Education (SUCCEED) (Table 1) is a coalition of eight southeastern engineering colleges managed in the College of Engineering at North Carolina State University. It is committed to a comprehensive revitalization of undergraduate engineering education through its four major components. SUCCEED's curriculum model, called CURRICULUM 21, conveys the coalition's theme: Engineering

Education for the 21st Century. This model aims to address the need to develop a new type of engineer who will be a multifaceted, technically competent integrator and problem solver who can interface with technical and other specialists in cross-functional team approaches to product innovation, development, and production process. CURRICULUM 21 consists of three interrelated learning stages for students: an integrated engineering core, an engineering design and process core, and a functional engineering core. With respect to engineering curriculum, SUCCEED promises to develop a process engineering degree program that is an integrated combination of traditional related engineering knowledge coupled with process engineering specific content. SUCCEED will also develop a multidisciplinary Bachelor of Science in engineering degree with a new disciplinary designation to meet the growing integrated engineering and management needs of the industry.

The Florida Engineering Educational Delivery System (FEEDS)

The Florida Engineering Education Delivery System (FEEDS) was established by the Florida legislature in 1982 to deliver graduate engineering education, primarily at the master's level, to engineers throughout the state at their place of work through distance learning technologies. FEEDS operates as a technology-based delivery system. It is a cooperative effort of the State University System and private-sector industries located within the state of Florida. The colleges of engineering at the Florida Agricultural and Mechanical University/Florida State University, Florida Atlantic University, Florida International University, University of Central Florida, University of Florida, and University of South Florida originate graduate courses and programs as primary centers for the delivery system. The University of North Florida and the University of West Florida, along with numerous industrial partners throughout the state, participate in the delivery of graduate engineering programs as cooperating centers.

Summary of Distance Learning in Engineering

Six universities are members of NTU and NUDC: Colorado State University, Kansas State University, University of Alabama, University of Maryland/College Park, University of Idaho, and University of South Carolina. NTU/SUCCEED university members are Clemson University, Georgia Institute of Technology, North Carolina State University, University of Florida, and University of Illinois/Urbana Champaign. SUCCEED/FEEDS university members are Florida A&M University, Florida State University, and the University of Florida.

Independently operating distance learning universities offering different certification in engineering, e.g., associate, predegree, degree, diploma, postgraduate, continuing education, certificate, and training, exist worldwide (Table 2). The Peterson's Directory of Distance Learning database revealed 24 universities offering undergraduate distance learning (Table 3). Further exploration revealed that there are other well-established distance learning universities under a different classification in Peterson's Directory.

Technologies Adopted for Distance Learning

Distance education began its life through correspondence utilizing one of the earliest forms of communication, i.e., print, which occurred on an international scale. The origins of some of most important ideas and techniques being used today have their roots in century-old events that occurred globally. Begun as a form of correspondence study, distance education evolved into a total-systems approach pioneered by Charles Wedemeyer, which was adopted by the Open Universities, principally the British Open University. This approach used print, broadcast, and recorded material and was distributed by radio and television.

An *Overseas Development Administration 1995 Education Report* revealed varied perceptions about distance education. The United Kingdom looks at it as a grown market, the United States views it as a second-class option, and developing countries are yet to be convinced of its benefits. The report cited cultural adaptability, attitudes, local point of contact, and student support as factors necessary for its success.

Among the distance learning technologies, the most popularly used is the videotape system (Table 4). A majority of the schools in Table 4 have a video-based system of course delivery. In this system, tapes are sent to students by mail for replay by students at different sites.

Telecourses offer the convenience of taking classes while at home or in the office by way of the student's television set. Brevard, Michigan State, Rochester Institute of Technology, University of Washington, New Jersey Institute of Technology, and New York University utilize the system of telecourses. Online courses facilitate instruction to any student who has a connection to the Internet. This is usually supported by a host of other technologies, such as two-way videoconferencing, live and interactive, and electronic mail. Acadia University in Canada, Brevard Community College, Rennselaer Polytechnic University, University of Houston, University of Washington, University of North Carolina, Stanford University, and University of Central Florida all have an established online-courses distance learning program.

Boston University's interactive-compressed video system utilizes three state-of-the-art PictureTel videoconferencing systems. These systems transmit at speeds of 56–384k (full motion video) capability. Stanford University's Stanford Instructional Television Network (SITN) utilizes digitization and compression of courses in video format, which are stored on a video server, making it available as an on-demand video streaming environment. Michigan State University, North Carolina State University, Oklahoma State University, Old Dominion University, Rennselaer Polytechnic University, University of Houston, and Southern Methodist University utilize the Satellite Broadcast Television System in their course delivery.

Access and Interactivity

Technology is looked to as a means to solve the problems of effectively delivering distance education. Distance education practitioners were the first to see the promise of the technological revolution as a means of unlocking the door of access for students and help distance learning institutions become the leaders of the "New University" (Hall, 1996). However, some distance learning critics would argue that since learning resources are scarce, bringing in more students would dilute the quality of these resources (Ehrmann). With advances in technology, these resources, e.g., books, communication facilities, and calculators, were mass produced, making them widely available to many learners simultaneously with enhanced quality. Today the computer has taken over as one of the most important, if not the most important, learning tool in accessing learning resources and enhancing learning at the same time. Online communication facilitates communicating with one another, transfer text/data files, obtaining information from computer databases, and transcending time and space constraints. Computer-mediated communication (CMC), or distributed learning environment, is a new medium in education and more specifically, distance education. The basic structural element of CMC is that all communications are stored on the system and are retrievable. Hence, this information is researchable and downloadable at any time. Its drawbacks include requiring access to expensive essential telecommunications facilities and equipment and familiarity with the technology itself. The interest is high in spite of these barriers because, like the spoken word, it is spontaneous and flexible. It is a powerful medium for communication and cooperative learning. Ehrmann cites four types of learner interaction achieved in a CMC.

Learners study instructive messages that are transmitted through the media. From the traditional lecture hall/textbook modality, access to these messages are enhanced with the new technologies, e.g., videotape, audiotape, desktop publishing, computer-mediated instruction, improved images, and dynamic displays.

The Stanford Online Project at the Stanford Center for Professional Development delivers engineering and computer science courses incorporating video with audio, text, and graphics in an on-demand capability.

Learners can take advantage of the tool's power and portability. The capabilities to analyze and solve problems are unlimited.

A host of universities require that all students own a computer. The Laptop program at Oklahoma University was implemented in the fall of 1996. This program was implemented based on the following reasons: the trend in engineering requiring a lot of computer usage; demand for more computing resources and services from the Engineering College Network (ECN), the increasing number of students already owning a computer, ECN capability of providing Internet access and engineering application software access, and the production of engineers with strong computer skills.

Connectivity with others, such as the faculty and fellow students, is achieved in real time. Traditional technologies of direct faculty-student and student-student contact is complemented by new technologies such as audioconferencing, text-based conferencing, and audiographics conferencing.

In the Stanford Online Project, students are able to asynchronously interact with the instructor and fellow students. Class videos are done in either QuickTime or Vxtreme format.

Time-delayed, conversation-based materials such as homework, projects, and assignments, are enhanced. New technologies, such as electronic transfer of files, asynchronous computer conferencing, and the fax, allow more frequent conversation and a new rhythm for learning with a wider range of expression and exploration.

Possible predictors of success in using CMC in distance education depend on the teacher's interest and familiarity with the technology, trust in the value of cooperative learning, and sufficient time to assess student contributions. It also depends on the student's ability to overcome all techno-socio-economic barriers in achieving mastery of the medium.

Quality of Learning and Accreditation

Research and evaluation studies show that achievement and satisfaction of students who learn via teachnology can equal those of students in regular classrooms (Johnstone, 1996). There are various factors at play in that transfer of learning. Information transfer is one. A survey of 400 students in two-way telecourses between 1988 and 1990 revealed that the amount of information transferred was the best predictor of learning and the strongest predictor of satisfaction was information transfer (Walker, 1992).

Another factor linked to meaningful learning is interaction with faculty. This has been shown in several studies linking interaction with learning. An Oklahoma Televised Instruction System survey in 1992 showed that 83% interacted with the instructor all the time and did not feel disadvantaged when it came to access to services. The same study revealed that distance education students performed equivalently in civil engineering but performed better in business, humanities, science, and social science. The students cited that problems with the telecommunication system, instructor style, method of instruction, and lack of library resources hindered their performance. In a 1993 survey of 30 video-based distance education students in various courses at an independent university, course completion was directly correlated with faculty-initiated contact by telephone call to their students (Towles et al., 1993). A survey of teleconference DL students delivered by two Canadian universities revealed that the goals of deep learning and critical thinking were achieved when teleconference took place more frequently, such as on a weekly basis compared to a biweekly basis (Anderson, 1994).

Delivery mode is another factor that can have an effect on learning. A study was done of the same graduate class in management technology delivered in the traditional method at Georgia Institute of Technology and the University of Alabama at Hunstville and by studio broadcast to students enrolled at National Technological University (NTU) at Colorado. In that study, the traditional students outperformed the remote students on the examination calling for understanding and articulation of basic concepts. However, the older NTU students outperformed the traditional students on questions calling for application and synthesis of course materials.

Student's attitudes on the distance education mode can also have a significant impact on the quality of learning. A less positive reaction to the physical distance learning environment and to the overall course was expressed by students at Valdosta State University. At a large midwestern university (remote site), telecourse students were compared with (broadcast) traditional students. High grades for telecourse students were associated with greater expediency, greater self-sufficiency, and less compulsiveness. For traditional students, high grades were associated with greater conscientiousness, emotional stability, soberness, shyness, and liberalism. A high rate of student retention and satisfaction with studies at the Open Polytechnic of New Zealand were attributed to students receiving a pre-enrollment counselling booklet.

Several factors can affect distance learners' satisfaction with interactive televised courses. A Ball State University survey revealed seven dimensions: Instructor/Instruction, Technology, Course Management, At-Site Personnel, Promptness of Material Delivery, Support Services, and Out-of-Class Communication With the Instructor.

Faculty attitude to distance education is mixed. A survey of faculty members in 57 public institutions revealed attitudes toward distance education. In general, faculty attitude was positive but became negative when it was applied to their own programs or courses. Experienced distance education practitioners and community college faculty had a greater overall positive attitude than faculty at four-year institutions. Faculty at four-year institutions expressed positive attitudes toward videoconferencing. In a 1994 evaluation of the seven Annenberg/CPB New Pathways to a Degree Learning Projects of seven institutions, faculty was of the opinion that mediated teaching was not comparable to a face-to-face environment.

While the efficacy of technology is becoming less of a question in distance education, the focus is being shifted to surrounding issues such as feelings of isolation of distance students who do not have any human contact with their instructors, how to provide effective advising and academic support services to distance students, and a guarantee of continued support to electronically delivered programs until the distance students complete their program.

The Western Cooperative for Educational Telecommunications at WICHE (the Western Interstate Commission for Higher Education) Principles of Good Practice came out of research on state policies governing interstate program delivery and on extensive reviews, discussions, and comments by WICHE. The Principles of Good Practice is endorsed by the boards of three regional accrediting bodies, the North Central Association of Colleges and Schools Commission on Institutions, the Junior College Division of the Western Association of Schools and Colleges, and the Southern Association of Schools and Colleges; the Colorado Commission of Higher Education; South Dakota Board of Regents; New Mexico Commission of Higher Education; the Montana University System; and the New Mexico Commission of Higher Education.

The Western Cooperative collaborates with the Western Governor's Association in assuring quality by recommending a shift in the focus of quality assessment away from the academic program and toward assessment of the learner. In this assessment the quality of the academic program will be judged by outcomes or the demonstrated competency of its graduates. The program's success in producing competent graduates should be made public because it will help students who are looking for quality programs.

The mission of the Florida Distance Learning Network is to improve student learning, achievement, and instructional techniques through increased access to distance learning in the most cost-effective way by:

- Maximized use of advanced telecommunication services based on applications needed for affordable distance education
- Interagency cooperation and partnerships
- Secured federal/private funds to support advanced telecommunications services and distance education
- Coordinated advanced telecommunications services and distance education services to maximize return on investment

Accreditation is a process that gives public recognition to educational institutions that meet published standards of quality. It is a fact that distance education is "becoming widely accepted but yet is still not mainstream and employers skeptical of a degree are likely to be even less accepting of one from an unaccredited school" (Non-traditional education, 1996, p. 22). Distance study accreditation through the Accrediting Commission of the Distance Education and Training Council provides distance education institutions with a single source of national recognition. The process of accreditation begins when a distance education institution that has been operational for two years submits an application for accreditation to the DETC offices. An in-depth self-evaluation report; a review of all courses by subject matter experts; a survey of students, graduates, state departments of education, federal agencies, Better Business Bureaus, and other official bodies; and an on-site inspection to verify information constitute the evaluation process. All reports are reviewed by the commission in conformity with all of DETC's educational and business standards. Once accredited, the institution must submit annual reports and be re-examined every five years. Accreditation is an important benchmark for educational quality (Johnstone, 1996). Of the 15 WICHE states, 12 require that only accredited institutions be granted approval to offer distance education within that state.

Quality assurance in distance learning is an important issue that is being addressed by higher education institutions and governing boards, state governments, and accrediting agencies. States can protect the education consumer by requiring educational providers to disclose their accreditation status. The traditional method used by the states to ensure quality is to require regulation and licensing for out-of-state institutions who wish to offer courses in their state. Licensing requirements are difficult in global electronic communication for two reasons: the location of the student studying at a distance is hard to predict and strict state licensing/regulation requirements can discourage quality institutions from offering courses. One example is the failed implementation of University of North Dakota's space program because of strict regulations in Washington. California and Idaho also have discouraged reputable distance education institutions because of their strict regulations.

At the Council on Postsecondary Accreditation (COPA) Professional Development Program on Distance Learning and Accreditation held in spring 1991, Steven Crow listed basic assumptions embodied in accreditation standards and criteria that may have direct implications on the way distance education is assessed:

- Accreditors try to locate distance learning within campus-based, traditional institutions offering traditional programs.
- Traditional institutions and programs have proven, documented means of showing educational effectiveness.
- The classroom faculty defines quality higher education.

Crow further expanded his argument by laying out three issues accreditors will have to deal with to respond creatively and responsibly to the rapidly changing distance learning technologies:

- New types of institutions will be shaped by new technologies.
- Consortial, shared, or purchased programs need to be dealt with appropriately.
- The disappearance of boundaries—program, institutional, political, and regional—will occur.

Conclusion

Technology has precipitated a new era of educational paradigm. Distance education faces an enormous challenge because it is an evolving field and is heavily dependent on a rapidly changing telecommunications industry. The standards by which educational quality of a distance-delivered course is measured is still based on norms set by the traditional university. If distance education will be judged through its own merits, then it needs to have its own set of criteria for evaluation, one not entirely based upon standards accorded the traditional university. When assessing the educational quality derived from a distance-delivered course, emphasis would need to be placed on the quality of its graduates and outcomes of the educational process, such as the skills and competencies acquired and validated in the workplace.

Table 1. List of Collaborative Agencies Offering Engineering Distance Learning and Member Universities

University	NTU	NUDC	SUCCEED	FEEDS
Arizona State University				
Boston University				
California State University Long Beach				
Clemson University				

Colorado State University
Columbia University
ECE at Carnegie Mellon University
Florida A&M University
Florida Atlantic University
Florida International University
Florida State University
George Washington University
Georgia Institute of Technology
GMI Engineering & Management Institute
Illinois Institute of Technology
Iowa State University
Kansas State University
Lehigh State University
Michigan State University
New Jersey Institute of Technology
New Mexico State University
North Carolina A&M State University
North Carolina State University
Northeastern University
Oklahoma State University
Old Dominion University
Purdue University
Rennselaer Polytechnic University

Southern Methodist University
University of Alabama, Huntsville
Utah State University
The University of Alabama
University of Alaska, Fairbanks
University of Arizona
University of Arkansas
University of California, Berkeley
University of California, Davis
University of Central Florida
University of Colorado, Boulder
University of Delaware
University of Florida
University of Idaho
University of Illinois Urbana-Champaign
University of Kentucky
University of Maryland at College Park
University of Massachusetts, Amherst
The University of Michigan
University of Minnesota
University of Missouri—Rolla
University of New Mexico
University of New Orleans
University of North Carolina Charlotte

University of North Florida	
University of Notre Dame	
University of Oklahoma	
University of South Carolina	
University of South Florida	
The University of Tennessee Knoxville	
University of Washington	
University of West Florida	
University of Wisconsin—Madison	
University of Wyoming	
Virginia Polytechnic Institute	
Washington State University	

Table 2. Worldwide Distance Learning Universities in Engineering

Source: British Open University, International Center for Distance Learning Database

University of South Pacific/Fiji	Swindon College/United Kingdom
Charles Sturt University/Australia	Edinburgh's Telford College/United Kingdom
Deakin University/Australia	University of Bath/United Kingdom
Engineering Education Australia/Australia	University of Paisley/United Kingdom
Open Training and Education Network/Australia	Granton Institute of Technology/Canada
Professional/Graduate/Educ Consort/Australia	Sault College of Applied Arts and Technology/Canada
TAFE External Studies College/Australia	Southern Alberta Institute of Technology/Canada
University of New England/Australia	St. Lawrence College/Canada
Monash University	British Columbia Institute of Technology/Canada

University of Southern Queensland/Australia	Confederation College of Applied Arts and Tech/Canada
Open Learning Institute of TAFE/Australia	Fanshawe College/Canada
CentroParaLa InnovationYDesarollodeLaEduc/Spain	Granton Institute of Technology/Canada
Angus College/United Kingdom	University of Waterloo/Canada
Bradford and Ikley Community College/United Kingdom	Birla Institute of Technology and Science/India
Cleveland Open Learning Unit/United Kingdom	Indira Gandhi National Open University/India
Henley College Coventry/United Kingdom	Lyceum College/South Africa
Inverness College/United Kingdom	Rapid Results College/South Africa
National Extension College/United Kingdom	College of South Africa/South Africa
Open College/United Kingdom	British Tutorial College/Tanzania
Open Learning in Scotland/United Kingdom	Central African Correspondence College/Zimbabwe
Plymouth College of Further Education/United Kingdom	Organizational Training and Development/Zimbabwe
Sandwell College/United Kingdom	Open University of Sri Lanka/Sri Lanka

Table 3. Undergraduate Distance Learning Universities in the United States

Source: Peterson's Directory

Arizona State College	San Diego City College
Butte College	University of California, Extension
Carlton University	University of Dayton, www.udayton.edu
Castle College	University of Idaho, www.idaho.edu
Hibbing Community College	University of Maryland—College Park, www.umd.edu
Howard Community College	University of Minnesota—Twin Cities Campus, www.umn.edu
Lakeshore Technical College	University of Missouri—Columbia, www.system.missouri.edu
Medical University of South Carolina	University of Nebraska—Lincoln, www.unl.edu
North Carolina State University, www.ncsu.edu	University of New Hampshire—Durham, www.unh.edu
Northern Virginia Community College	University of Oklahoma, www.uoknor.edu
Pennsylvania State University, www.psu.edu	University of South Carolina—Union
University Park Campus	University of Wisconsin—Eau Claire, www.uwec.edu
Rochester Institute of Technology, www.rit.edu	

Table 4. Engineering Distance Learning and Member Universities

Arizona State University	University of Arkansas
Colorado State University	University of California, Berkeley
Columbia University	University of California, Davis
ECE at Carnegie Mellon University	University of Central Florida
Florida Atlantic University	University of Colorado, Boulder
Florida International University	University of Delaware
Florida State University	University of Florida
George Washington University	University of Idaho
Georgia Institute of Technology	University of Illinois Urbana Champaign

GMI Engineering & Management Institute	University of Kentucky
Illinois Institute of Technology	University of Maryland at College Park
Iowa State University	University of Massachusetts, Amherst
Kansas State University	University of Michigan
Lehigh State University	University of Minnesota
Michigan State University	University of Missouri—Rolla
New Jersey Institute of Technology	University of New Mexico
New Mexico State University	University of New Orleans
North Carolina A&M State University	University of North Carolina Charlotte
North Carolina State University	University of North Florida
Northeastern University	University of Notre Dame
Oklahoma State University	University of Oklahoma
Old Dominion University	University of South Carolina
Purdue University	University of South Florida
Rennselaer Polytechnic University	University of Tennessee Knoxville
Southern Methodist University	University of Washington
University of Alabama, Huntsville	University of West Florida
Utah State University	University of Wisconsin—Madison
University of Alabama	University of Wyoming
University of Alaska, Fairbanks	Virginia Polytechnic Institute
University of Arizona	Washington State University

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Paper Session

Developing Educational Materials in Java: A Report From the Front Lines

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Key Words: Java, simulation, computer-based education

Abstract

We have been using Java for the past two years to develop a variety of educational materials to supplement both traditional instruction and Internet-based instruction. Our efforts have focused on three projects that vary in course level, content, and style of interaction. Unlike the simple Java applets you see on the Web, these are very sophisticated simulation environments that are at the cutting edge of Java development.

Our freshman Overview of Computer Science course (hereafter referred to as CS100) uses a set of elaborate Java simulations in a closed lab setting where students work in small groups to explore a problem domain while the instructor circulates among the students providing assistance as necessary. The Concurrency Simulator used in our sophomore level Introduction to Parallel Programming course (hereafter referred to as CS240) is used for demonstration during classroom instruction and for students to complete programming assignments outside of class. Our Operating Systems course (hereafter referred to as CS345) uses Java applets to provide student interaction in an Internet-based course.

After providing an overview for each of these projects we discuss the Java programming environment, successes and problems encountered during implementation, common factors in the design of materials, measuring the educational effectiveness of the materials, and advice to others on the development of Java-based educational materials.

The Watson Project

In 1992 the authors were awarded a grant by the National Science Foundation (DUE 9254317) to develop a collection of "hands-on" laboratory experiences to support a breadth-first introduction to computing. The project was based on the recognition that while many schools were beginning to offer breadth-first introductions to computing in response to the Denning report (Denning et al., 1989), there was (and continues to be) little in the way of software available to support these courses.

Topics covered in Louisiana Tech's CS100 class can be grouped into four broad categories: end-user applications, software development, architecture and digital logic, and the limitations and potential of computing. The authors believed that if freshmen-level students were to gain any real insight into such a vast array of topics most would need some form of hands-on experience. Hence, the authors launched the Watson project—so named because its modules are supposed to assist the student in learning fundamental computing concepts. Given the real life experiences of Alexander Graham Bell and the fictional exploits of Sherlock Holmes, it seemed that "Watson" would be the perfect name for our "assistant."

In its original incarnation, Watson consisted of nine independent modules written in C using SUIT (Simple User Interface Toolkit) (Conway, 1992). These modules included:

- a spreadsheet lab
- a relational database lab
- a data structures lab focusing on stacks and queues
- a specialized imperative programming language for drawing graphical objects
- a more general Pascal-like imperative language
- a functional language, based on Lisp
- an assembly language and machine organization lab
- a digital logic lab
- a finite state automata lab

The original Watson labs were used at Louisiana Tech University for over three years (Kurtz, 1994; O'Neal, 1995). While the labs were very popular with the students, they were never robust enough, despite our best efforts, to be exported to other schools. The primary reason for this was that Watson had been constructed on top of SUIT, a pre-Java "platform independent" interface library. Since one of the project goals was portability of the software, SUIT seemed like an excellent choice—it promised to allow Watson to run on PCs, Macs, and Unix workstations. As the project progressed, however, it became clear that SUIT was not up to the task. In fact, we could never get SUIT to behave reliably on the most popular platform of the day, Windows 3.1, even though we devoted substantial resources to completing a port of SUIT to Windows 3.1

With the release of Java, it became obvious that if Watson was ever to have an impact beyond Louisiana Tech the labs would have to be re-implemented in Java. Thus, beginning in the summer of 1996, we began a major push to rewrite Watson from scratch in Java. At the present time we have classroom tested the Java versions in six of the nine labs. A seventh lab, the imperative programming lab, is under active development. An eighth lab, based on Prolog, is in the initial design stage. The functional and finite automata labs have not been ported to Java.

A great deal of effort went into designing a "look and feel" for Watson that is consistent throughout the labs. The process of deciding on a set of interface guidelines is never easy, but was complicated in our case by the large variety of laboratory experiences we wanted to present to the students, ranging from spreadsheets and databases to digital circuit design. Our goal throughout this process has been to create an environment that is both intuitive and easy to use.

We have observed that many beginning students feel uncomfortable in front of a keyboard. The mechanics of typing and entering commands and correcting mistakes are difficult for some. A more widely recognized problem is the difficulty students have with programming language syntax. Our approach to these problems is to use syntax directed editors for programming languages, so that only syntactically correct programs can be entered, and to limit keyboard input wherever practical. For example, most of our laboratory experiences require no keyboard input at all, only mouse presses. A few of the labs require limited keyboard input, such as the imperative programming lab, where the name of an identifier must be entered when it is first declared.

In order for Watson to gain the widest possible acceptance, it was deemed important that the Java-based labs be accessible through the Web. All of the modules discussed below were developed under Version 1.02 of Java and thus run under Netscape's Communicator 4.0 and Microsoft's Internet Explorer 3.0. These labs are available at http://www.LaTech.edu/~watson/. The one exception to this rule is the imperative lab, which is being written in Version 1.1 of Java—a version that is supported only by the latest versions of Web browsers.

Spreadsheet. The spreadsheet laboratory allows students to enter numbers, formulas, and text into a simple spreadsheet. The spreadsheet supports basic arithmetic operations, such as addition, subtraction, multiplication, and division; and built-in functions, such as summation and average. This is the first lab completed by the students and, as such, introduces them to the look and feel of all the Watson modules.

Database. Students study relational concepts using an academic database that contains tables of student information, faculty information, and course-scheduling information. The fundamental operations of project, select, and join are first introduced in a Query by Example (QBE) mode. Students are asked to use QBE to solve particular queries, such as to list the name and gender of all students who earned a C or higher in computer science courses. At the same time QBE is being performed, the corresponding relational equations appear on the screen. After becoming familiar with relations and queries using QBE, students are asked to perform queries using relational equations directly.

Data Structures. Students study algorithms to manipulate linear structures, such as stacks and queues, and tree structures. These data objects are shown on the screen and manipulated directly using buttons labeled "push," "pop," "enqueue," "dequeue," and so forth. A typical problem is to reverse a queue, which requires students to push all of the items in the queue onto a stack and then pop the items off the stack and put them back in the queue.

Graphics. The graphics laboratory has three major divisions of the screen: a drawing window, an object declaration window, and a program code window. Objects supported by the lab include points, lines, circles, polygons, and the abstract concept of distance. Commands include assign, draw, erase, color, loop, increment, and decrement. Initially students draw objects directly in the drawing window using mouse operations similar to those supported by most drawing packages. As objects are drawn in the drawing window, the corresponding declarations and program code automatically appear in the appropriate windows. In later exercises, students must first enter the declarations and commands (using a syntax-directed editor) that will be executed to draw a picture. By the time students complete this lab, they should have an understanding of data types, variables, constants, assignment, output, command sequencing, and simple repetition. A screen snapshot from the graphics lab is shown in Figure 1.

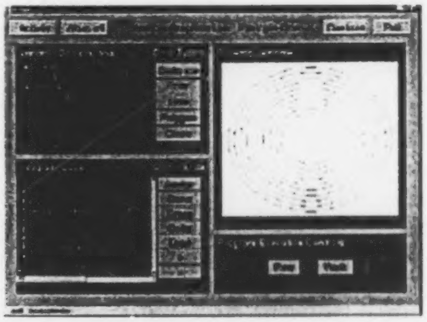

Figure 1. The Watson Graphics Laboratory

Imperative Programming. Imperative programming is introduced using a Pascal-like language in a tightly constrained lab environment where only syntactically correct programs, including type checking, can be entered. In addition to repetition and sequencing covered in the graphics lab, the imperative laboratory introduces the concepts of selection, using an if command, and procedure encapsulation, with parameter passing to transfer information. There are only two data types in the language: integer and string.

Assembly Language and Machine Organization. This lab involves a simple register-based computer with a 16-instruction machine language. Students construct assembly language programs using a mouse-oriented, syntax-directed editor. The lab shows the state of the CPU, including register contents, program counter, and flag bits. In addition, the contents of memory are visible. To help students become familiar with various number bases, the lab has two modes: binary and hexadecimal.

Digital Logic. Three basic gates are available in this lab, a two-input AND, a two-input OR, and a single-input NOT. Students construct circuits by manipulating on-screen gate symbols that can be connected together using the mouse. The types of problems solved include construction of XOR, adders, data selectors, encoders, and decoders. The lab automatically generates truth tables and Boolean equations from the students' circuits.

The Concurrency Simulator

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The Concurrency Simulator is used in a sophomore-level course, CS240, to introduce parallel computing early in the undergraduate curriculum (Kurtz et al., 1998a). The course and software was developed as part of a National Science Foundation grant (CDA-9414309) awarded to the authors in 1994 (Kurtz et al., 1998b). This simulator is unique since it integrates a graphical topology into the programming environment. This makes algorithms much easier to express and, combined with a context-sensitive editor, makes it easy for students to enter their algorithms without becoming bogged down in the details of language syntax.

There were two primary inspirations for the development of the Concurrency Simulator. One of the textbooks we used in the course (Andrews & Olsson, 1993) gave three alternative solutions to the dining philosophers problem; each solution was presented using an accompanying diagram, as shown in Figure 2, to explain the code. The centralized solution to the left has one fork server surrounded by five philosophers. The decentralized solution in the middle has a server for each fork in between each pair of philosophers. The decentralized solution to the right has a server for each philosopher; these servers communicate with each other about the forks. We designed the Concurrency Simulator to use a topology similar to these diagrams as a starting point for the development of an algorithm in an integrated programming environment.

The second inspiration came from Parallaxis, a programming environment for SIMD simulations (BraŸnl, 1993). After developing a Parallaxis program you have the option of displaying the program execution graphically using an appropriate topology (e.g., grid or ring) with variable values shown in a range of colors. We combined these approaches in our Concurrency Simulator. The topology of the problem solution is an integral part of the programming environment, and it initiates the development of an algorithmic solution. At run time this topology illustrates program execution by changing colors of the program components based on their current execution state.

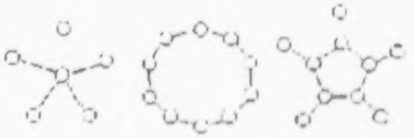

Figure 2. Topologies for the Dining Philosophers

Our Concurrency Simulator can be used to illustrate three approaches to parallel algorithm development: semaphores, monitors, and rendezvous (Ben-Ari, 1982). All three approaches share a common look and feel as shown in Figure 3.

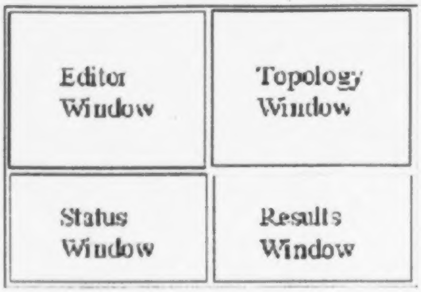

Figure 3. Screen Layout

There are four windows on the screen: the top two are used for program entry and the bottom two display program execution. The student first specifies the topology. The objects vary depending on the paradigm:

- Processes and semaphores
- Processes and message links for rendezvous
- Processes and monitors with entries and condition variables

Clicking the right mouse button on an object displays a popup menu with options to copy an object, show code for the object, or delete an object. Objects are named by a single letter and a digit; the digit is automatically assigned as each new instance of that object is created. For example, the process associated with a philosopher may be named A and numbered A0, A1, A2, and so forth.

The editor window displays:

- Source code for the processes
- Source code for the monitor entries
- Declarations and initialization for the message links, semaphores, or condition variables, as appropriate

The program is entered in a point-and-click environment where the only keyboard entry is for literal values or the names of objects when they are declared. The student has the choice of mouse entry using a virtual keyboard or typing directly on a physical keyboard. This editor is context sensitive. Only proper types are allowed, and when variables are selected it is from a popup menu of all variables of the appropriate type that are currently visible. A process is defined starting with a basic skeleton with placeholders for <declarations> and for <statements>. Clicking on a placeholder brings up a menu of acceptable substitutions, which are either combinations of source code and other placeholders or simply source code. Program development continues until there are no placeholders left to be specified. All program code is syntactically correct after entry is completed. The topology can be modified or expanded as the algorithm is fully developed.

Output as a result of Write statements appears in the results window as the program executes. The status window shows the various states of processes in written form. For example, for monitors the queue of waiting processes for all entry points and condition variables are shown. At the same time the topology displays the status of processes through color changes. For example, when a process is executing outside the monitor, it appears yellow. When a process is inside the monitor and executing, both the process and the entry point are green. When a process is blocked on an entry point or a condition variable, both objects are displayed in red. A sample screen for the monitor lab is shown in Figure 4.

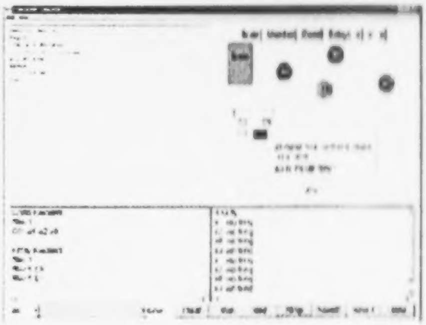

Figure 4. Screen image for monitor lab

Although the implementation details for the Concurrency Simulator are beyond the scope of this paper, we can give a general idea of the complexity by briefly describing two components. The context-sensitive editor allows the user to specify in data files the language syntax as well as the options on the popup menus of choices. The editor reads in these components and creates an appropriate user interface. An attribute-like mechanism is used to create the context sensitivity (Reps, 1989; Slonneger, 1995). Using this general mechanism made it easier to create distinct editors for each of the paradigms without having to redo the internals of the editor code.

The runtime environment for the simulator is threaded with a language interpreter running for each process shown on the topology. Consider the Dining Philosophers topology shown in the center of Figure 2. There are 10 interpreters running simultaneously, one for each of the philosophers and one for each of the forks. There is a generalized interconnection network underlying these processes that handles the message passing via the links. Despite this complexity, performance has been acceptable on all Pentium-level machines.

Java in an Internet-Based Course

Our Operating Systems course (CS345) was very traditional: we used the "dinosaur" book (Silberschatz, 1997) and students had to extend the Nachos system (Christopher, 1997). The first step to export the course to the Internet was to transfer all overhead slides into PowerPoint presentations with animation and add the narration. We have augmented the presentations with three types of multimedia materials: still pictures, live video clips, and snapshots of handwritten materials from an electronic whiteboard. Live video clips are extremely large even with MPEG compression and have been used sparingly. We have found still pictures with an accompanying audio narration to be nearly as effective as video clips and require

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considerably less space. We have found an electronic whiteboard to be an effective way to present certain types of materials. Although typed presentations are appropriate for exposition mode, they are less effective for a problem-solving mode. To capture a sequence of handwritten snapshots from a whiteboard with an accompanying audio narration is much more natural than to type the same solutions into PowerPoint. It also takes much less effort to develop the materials, particularly when equations or numerical solutions are involved.

The most interactive components we have added were developed in Java. In particular, we have developed a sequence of interactive modules covering major topics in the Operating Systems course. These modules have two modes of interaction: simulation where behavior is animated based on input data and exercise where the student must predict the behavior. Figure 5a shows the exercise mode for CPU scheduling.

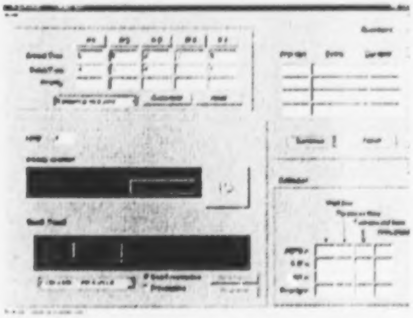

Figure 5a. CPU scheduling (exercise mode)

The upper left area is for input data that is either randomly generated or input by hand. The lower left section displays the scheduling process dynamically, showing both the ready queue and Gantt chart. In exercise mode the upper right area is used for student input of the next event; in simulation mode a scrollable trace of events is displayed. The lower right area shows statistical results after the simulation is completed; in exercise mode students enter requested values.

We have a variety of these modules throughout the course. Figures 5b, 5c, and 5d show screen snapshots for paged segmentation, page replacement, and disk scheduling.

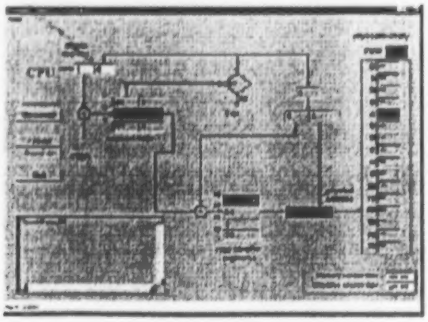

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Figure 5b. Paged segmentation (simulation mode)

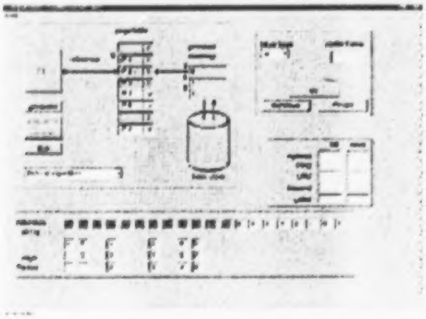

Figure 5c. Page replacement (exercise mode)

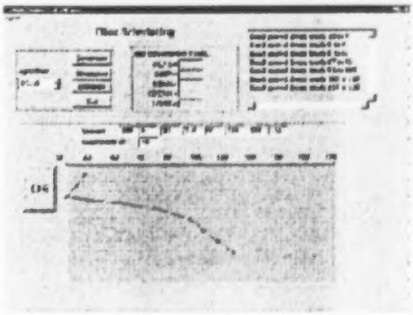

Figure 5d. Disk scheduling (simulation mode)

Java as a Programming Environment

For each of these projects we selected Java because of the language facilities, such as threads, and because the code is platform independent. We have found interfaces to be an acceptable substitute for multiple inheritance.

Java is a popular language that many regard as a cleaner version of C++. Compiling is extremely fast and the bytecode files are small. However, execution is interpreted and thus slower than native-code programs. But, Just-in-Time compilers are making this difference less noticeable. The newer programming environments, such as Symantec caf , Microsoft J++, and Borland JBuilder, substantially reduce project development time compared to the original Sun Java JDK. The language is very "clean" and does not result in errors commonly associated with C++, such as segmentation faults and core dumps.

Despite these benefits, we have also experienced difficulties. The most significant problems have been associated with the APIs. Although the core language is easy to master, particularly for those familiar with C++, the learning curve for the APIs is

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very steep. Java is a recent language and still evolving. The transformation from version 1.0 to 1.1 was nontrivial. Event handling has changed significantly, and this required extensive recoding.

However, many of the new features in 1.1 solved problems that were plaguing us. For example, the editor in the Concurrency Simulator displays source code in string format, but the internal editor objects are Java classes created dynamically. In version 1.1 it is possible to save Java objects to files. Using Java 1.0 we could not save source files between sessions, but the transition to 1.1 solved this problem. Converting the event handling was painful, but the new mechanism is much more robust and acts more like callback functions expected in a point-and-click environment.

Another problem is platform independence. Although Java has made great strides in the development of a platform independent language that can be viewed on a variety of machines via the Internet, in reality the solution is far from perfect. There are a variety of small problems, such as color maps changing, and larger problems, particularly when the viewing environment is based on a different version of the language than the development environment. The evolution of Java will continue to cause some difficulties, but we are convinced we have made the correct language choice for these projects.

Issues Involving Development

Implementation of quality course materials using Java can easily demand more time than a faculty member has to give, even when state-of-the-art hardware and software are used. Faculty members often realize that they must turn to others (primarily students) for help. However, this "help" may backfire, with the training and coaching of the students taking more of the developer's time than developing the software directly. Factors that should be considered when working with students to develop Java software include (1) student ability and knowledge, (2) the learning curve, and (3) software and hardware resources available to the student.

It is important not to overwhelm the student initially; start off with a relatively easy assignment that will lead to success. We have found a simple calculator project provides a gentle, yet meaningful, introduction to Java. If you have multiple students using the same software environment, encourage peer learning as much as possible.

Students have different personalities and require different management styles. Some students perform best if they are allowed to use their creative talents while others require closer supervision and guidance. In particular, try not to suppress the creative student.

We have employed students on projects by either paying them cash (graduate assistantships or hourly wages) or "paying" them with credits (special topics courses or thesis credit). Paying with credits may appear to be cost effective but, in some cases, has not worked out well. Special topics courses are difficult to manage and difficult to judge when enough work has been completed, particularly when most students expect to get an A in such a course. Also, the time frame of a single quarter or semester often does not provide sufficient time to both climb the learning curve and still get useful work out of the student. One approach that has worked fairly well is to tell prospective student workers who have little background in Java but who still wish the join the project that an up-front commitment of two quarters or semesters is required in order to earn credit.

Working for money gives more direct leverage over the student, but if the student's productivity begins to slip, it is often not a simple matter to replace him or her; again, the costs associated with the learning curve must be carefully weighted.

Regardless of which approach is adopted, careful supervision on the part of the faculty member leading the project is critical for success. It is a fallacy to believe that the faculty member can simply concentrate on the high-level design aspects of the project and leave it to students to produce reliable code. The faculty member must be willing to get his or her "hands dirty" and become directly involved with coding and quality assurance issues to produce a useful product.

Common Factors in the Design of Materials

Although we have presented a variety of Java projects, there are certain design features we have found to be important in each of these efforts. Perhaps the most important principle is to present a consistent interface. In the Watson labs the interface has a similar look and feel despite a wide range of topics covered. The Concurrency Simulator covers three different paradigms, but each has a similar interface. This is also true for each of the simulations developed for Operating Systems, despite the fact the topics are quite different.

Another principle is modularity—materials should be divided into small components that can be used by the students in a variety of ways. For example, in the Operating Systems course we include historical information, human-interest items, and frequently asked questions. These materials are "optional" and may be skipped by some students. The wide variety of labs in the CS100 course is neatly modularized and may be used in a many different ways. While it is important to allow the student the flexibility to explore different avenues of information, the student should be kept on track to ensure progress through the course materials.

A related factor is to allow for a variety of instructional approaches ranging from unguided exploration to self-test modes. Self-test mode is similar to simulation mode except each student can test his or her knowledge in a nonthreatening, nongraded environment. Students can check their approaches by switching back to simulation mode. We believe it is important to provide a self-test environment separate from quizzes and exams in the course.

Experience in the Classroom

The Watson labs are the oldest and the most mature of the projects discussed. The first field testing using labs developed in C was more than four years ago. Use of these early labs helped us develop many of the educational principles that permeate all of these projects. The new Java-based labs have been introduced over the last year and a half.

Students seem to enjoy the labs. More importantly, these labs allow instructors to present "advanced" topics, such as digital circuit design, to naive audiences. Recent studies conducted by Rugg and O'Neal (Rugg, 1997) show, for example, that students given a data structures lecture alone scored on average 10%–15% lower than students who have received the lecture plus the data structures lab.

We are using the Concurrency Simulator for the second time and the results have been encouraging. Students using the context-sensitive editor have virtually no learning time to master the language syntax; the small learning time is associated with how to use the point-and-click environment. This allows students to concentrate on the logic of their algorithms and not on the syntax of the programming language. These results are similar to what is found in the graphics and imperative labs of the Watson project.

Using the topology as an integral part of the programming environment has been very helpful both in algorithm development, since many details can be handled by the topology itself, and in debugging the algorithm. The combination of the results window, status window, and changing colors on the topology makes it easy to spot and correct problems. We illustrate this by discussing the Dining Philosophers problem.

The Dining Philosophers program is subject to deadlock if initially every philosopher picks up the right fork before the left fork. One way to solve the deadlock is to have one philosopher pick up the forks in the opposite order from the other philosophers. In a text-based system this requires introduction of an if statement in the program to make sure one philosopher (usually the first or the last) picks up forks in the opposite order. This extra if statement starts making the algorithm difficult to understand. However, by integrating the topology into the program environment we have a very easy solution using the Concurrency Simulator: simply reverse the links on the topology and don't change the source code at all.

We have completed the initial development of two Internet-based courses: Operating Systems (CS345, described in this paper) and Data Structures. Both use Java applets to allow students to explore small problem domains and both are being tested for the first time in an Internet-based framework. It is too early to report on definitive results, but it is clear that Java adds student interaction to an otherwise static environment. Preliminary results on course evaluations indicate the a self-paced environment is suitable for some students, particularly nontraditional students or more mature students, but does not work so well with the typical 19- or 20-year-old student.

Advice for Potential Developers

Before embarking on a major effort to develop Java-based software it is critically important that the administration realize not only the potential benefits for such development but also the costs. Estimates vary, but the cost to develop 1 hour of interactive computer-based materials ranges from 20 to 50 hours, depending on the level of simulations and the amount of intelligence built into the software. These are nontrivial costs that make initial development very expensive. These costs will decrease as you gain experience and the development tools become more sophisticated, but they will remain high for the near future. This is particularly true for computer science where the subject matter is continually evolving. We have been fortunate to have support from two NSF grants, but for those who do not have external support the school administration needs to be willing to contribute release time, student labor, hardware, and software if real progress is going to be made in developing Java-based educational materials. The youngest assistant professors are often the faculty most interested in developing such materials. It is critically important that the administration commit up-front to the acceptance of this work as valid applied research that would lead to a favorable tenure decision. Without such a commitment the best and the brightest will not be able to participate.

To develop any substantial amount of material, it is necessary to build up a cadre of student programmers. Several of the components described in this paper were parts of M.S. theses. Special topics courses can also be used with undergraduate students. Even if the projects are different it is important that these students work on sharing their knowledge about Java development. This is very important for overcoming the initial learning curve to master the library of APIs.

A significant challenge is to construct stable software that works reliably in an academic environment. Since one of the major purposes of these projects is to hide much of the complexity of real systems and languages—so that students can concentrate on problem solving rather than on learning the intricacies of real systems—student frustrations result when labs crash, are inconsistent, or display other behavioral problems.

As entering students have more and more exposure to graphical user environments, such as Windows 95, their levels of expectation as to reliability and ease of use continue to increase. It is truly a humbling experience to watch 30 kids discover several major flaws—all in less than one hour—in a system you have spent months developing and carefully testing. As Java matures and our code continues to be field tested in the lines of the classroom, stability is being achieved.

You must allow for extensive field testing of pedagogical effectiveness. We have found that some items that work well in the hands of an expert don't work so well for more naive students. You must be willing to modify (or even abandon) the software based on classroom testing. We have developed several Watson labs (e.g., Lisp programming) that we no longer use today because the programming environment was too difficult for students or the intended pedagogical goals were judged to have not been met.

Developing sophisticated Java-based software is a nontrivial task. You need to be willing to devote the necessary resources to the project. But once the software is fieldtested, modified, and tested again, you will find the effort worthwhile.

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Inspiration, Imagination, & Interaction: Students and Technology-based Creativity Tools

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Key Words: technology, creativity tools, educational software, multimedia, Internet

Overview

Anyone can make something using HyperStudio, Print Shop, or Amazing Writing Machine. However producing a unique, exciting, motivating, and relevant project involves inspiration, imagination, and interaction. Creativity is the key. This paper explores ways to guide students through the process of creating an innovative project using technology-based tools including software selection, project ideas, and learner guidelines. If your students are just making, it's time to start creating!

Creativity

Creativity involves using the imagination to invent original ideas. Most of us exhibit some elements of a "creative" person. Creative people seek change and adventure. They act on impulse, challenge rules, and like to explore new ideas. A creative person "goes with the flow" and prefers flexibility over conformity. Let's explore some words that relate to creativity. It is hoped that the following I's and matching Internet sites and software will help stimulate ideas for creative student projects.

Innovation: the process of creating or discovering new things and ideas
Interest: a feeling of curiosity or concern
  http://www.arts.ufl.edu/art/rt_room/@rt_sparkers/@rt_sparkers.html
Inspiration: a sudden original idea
  http://www.hipark.austin.isd.tenet.edu/home/projects/kinder/Bay/bay.html
Imagination: the ability to create new ideas of things you have never experienced
Incubate Ideas: give your thoughts time to grow
  http://magic.usi.edu/magic/westterrace/fish/fish.html
Insight: you understand the nature of something
  http://edweb.sdsu.edu/edfirst/sandiegozoo/quest.html
Inquiry: an investigation or examination for details
  http://avocado.dade.k12.fl.us/projects/spiders/
  http://www.ilt.columbia.edu/k12/history/demo.html
Interaction: action between people, groups, or things
  http://www.huensd.k12.ca.us/beach/hbsrspcalka.html
Improvise: to build with the tools at hand
  http://www.li.net/~stmarya/stm/home.htm
Ignition: to start with a flame or an explosion

http://www.gsn.org/project/newsday/index.html

Influence: to change the world through your ideas

Be a leader! Take a stand! Be seen!

http://met.open.ac.uk/heronsgate/projects/acidrain/acidrain.html

Introduce: provide a good overview

Gain attention. Draw interest. Build enthusiasm. Give them a lollipop. Draw them in.

http://magic.usi.edu/magic/subjectareas/culver/hero.html

Intrigue: catch interest or fascination with new ideas or facts

http://www.itdc.sbcss.k12.ca.us/curriculum/tobacco.html

Instinct: be plugged into the needs of your students!

Instinct can be an asset: know your kids

http://www.whitman.edu/~lynnda/oldcyoa/cyoa.cgi

Integrate: integrate technology, multiple intelligences, people, content, art & math

http://www.granite.k12.ut.us/Jefferson/studentw.htm

http://miavx1.muohio.edu/~Dragonfly/

Intensity: keep exciting high, it builds creativity

Provide large blocks of time

Interfere: Don't! It's the student's project, not yours

Give the keys to the kids and let them drive.

American Girls

Intermission: give it time to come together

Give it a rest. Put it on a shelf and come back later.

Interview: interview kids about their progress for oral histories

Do Your Own 60 Minutes Show

http://cspace.unb.ca/nbco/pigs/croft/leaders/

Invent: create something new.

Be an inventor. Be a Builder!

http://grid.let.rug.nl/~welling/usa/usa.html

Investigate: Explore information. Examine options. Experiment with ideas. Weigh Options.

Insist: Insist on citations

http://www2.ncsu.edu/ncsu/cep/ligon/portfolio.z.m/india.html

Intoxicate with excitement, enthusiasm, excellence...

Types of Creativity Tools

There are many types of creativity tools. Although some students use adult tools such as ClarisWorks and Microsoft Works, there are many specialty tools for kids. Tools such as ClarisWorks for Kids, The Writing Center, and Amazing Writing Machine are designed for text-rich projects and KidPix, Print Shop, and Print Artist are often used to create or organize graphics. There are also tools for making music such as SongWorks. Data and calculation tools are also available for children. For example, Crunchers is a spreadsheet for kids. HyperStudio is an example of a creativity tool that can be used for text, graphics, audio, video, and animation. You can also find useful tools on the Internet such as:

http://www.cybersolve.com/tools1.html

http://homepage.interaccess.com/~wolinsky/measure.htm

http://www.aquarius.geomar.de/omc/

http://www.hypersurf.com/~gconklin/school/mm2.htm

Functions of Creativity Tools

When selecting a creativity tool, first determine how the tool will be used. Do you prefer a flexible tool that can be used across grade levels and subject areas? Or, are you seeking a tool that will fit with a particular thematic unit?

Open-ended creativity tools such as word processing, database, spreadsheet, graphic, animation, multimedia and web development software can be used for a variety of projects. These tools are not dependent on a particular topic or theme. The advantage of these tools is that once students gain generic skills, they can use the software with almost any project. The disadvantage of open-ended tools is their lack of ideas, graphics, and information resources that might be helpful for a particular type of project.

Project-based software give students lots of educational ideas and resources as part of the program. For example, Writing Center provides project ideas and checklists, Amazing Writing Machine helps students develop poems, letters, and essays, Storybook Weaver encourages creative writing with interesting backgrounds and graphics. Some programs such as Opening Night help students create plays.

Thematic tools provide students with information, graphics, sounds, and other resources related to a particular content area. For example, Edmark's Imagination Express series provides an environment for students to write multimedia stories and reports on the topics of oceans, rainforests, neighborhoods, castles, pyramids, and history.

Integrated creativity tools provide elements from all the previous categories. For example, Encarta is an electronic encyclopedia that provides a notetaking area, projects ideas, and activities. The Art Lesson is a software package based on a children's book that incorporates a "interactive book" with graphics activities.

Creative Projects

Building a HyperStudio stack about the food pyramid, using a Print Shop banner on a bulletin board for reading month, or creating a biography on a president using the Amazing Writing Machine are all common K-12 computer-based projects. These tools are easy for creating simple, but effective communications. Unfortunately the power of many of these tools is often underutilized. The key to using creativity tools is the project. Given a flexible, information-rich learning environment and a meaningful, problem-based assignment, technology-based creativity tools can be used to produce innovative, creative products that demonstrate student skills including critical thinking, problem-solving, and reflection. For example, encourage students to develop subject-area projects that apply what children are learning in the classroom. Ask students to develop an action plan or presentation. Encourage student prose, personal expression, and reflective communications.

Students can take many roles in a creative project. For example, the teacher could develop the initial project and students could add to it, or teachers could start the project and students could finish it. You could also put the students at the center of the project. Students could develop a project and use it themselves, or create something for others to use. Encourage students to develop collaborative projects. Students might take the role of researcher, notetaker, keyboardist, illustrator, editor, writer, or proofreader.

Why Bother?

Creative projects take planning and lots of time to implement. They require alternative assessments and new roles for students and teachers. In the long run, it's worth it. Creativity tools can provide a wonderful delivery system for meaningful, problem-based learning projects. To develop an innovative product, students must become critical thinkers, evaluators, and reflective thinkers. Creativity tools can help students organize and share information using a variety of channels such as text, graphics, audio, video, and animation.

The key to a creative project is not the technology, but the inspiration, interaction, and imagination that children bring to the creativity tools.

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General Session: Technology Training/Staff Development

Teaching About Versus Learning With Technology

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Key Words: technology training, elementary, secondary, higher education

Why do we still have a technology curriculum in K–12? Haven't we learned that mandating a technology curriculum isolates the technology from use in the basic curriculum areas of math, language arts, science, and social studies? These questions and more will be the focus of our presentation on the importance of using technology as a tool for learning with technology. We will share ideas, and hope that you will share yours, on how to get educators to use technology as the ubiquitous tool it should be in the learning environment of the 20th and 21st century.

The way we teach, learn, transmit, and access information today remains largely unchanged; the basic way that students are asked to learn has not changed for centuries, while around us technologies, including communications technology, is transforming the way we live and conduct business. Let us look as the following conditions that exist in most American schools today:

- Faculty use the "talking head" approach to convey information; students are usually the receivers of information rather than active participants in learning.
- The textbook remains the basic unit of instruction; the memorization of its contents tends to be the primary measure of educational success.
- Teachers work largely in isolation; collaboration with other educators is limited, while in most other professions colleagues collaborate, exchange information and ideas, and develop new skills on a continuing basis.
- While technology is often found in educational institutions, its instructional use is often limited to that of an expensive electronic workbook or page turner.

The Problem

Why do we still have a technology curriculum from K–12? Haven't we learned that mandating a technology curriculum isolates the technology from use in the basic curriculum areas of math, language arts, science, and social studies? The inference is there, for sure, but inferring the use of technology within the curriculum areas is not what works—we know that from the past 18 years or more of teaching about the technology—not with the technology. However, many are still writing and dictating the use of technology curriculum. We see it at the state and local levels. It isn't that there is not some attempt to integrate the use of technology into the learning environment—but what do we read first when the "new" technology curriculum appears on our desks or our computer? Not how we can use it to help assist students learn about solving problems in our everyday life, not how we can use the Internet to get in contact with our local government officials to learn about their stance on a given issue, not working with classes in various parts of the world in learning about different cultures, not the analysis of data collected from around the world from science experiments on acid rain. We read in the first few pages: "the student demonstrates knowledge and appropriate use of hardware components, software programs, and their connections"; "start and exit programs as well as create, name, and save files"; "initiate the disk"; "load paper properly"; "connect the computer to CD-ROM." Yes, somewhere toward the end of the document we may read some ideas on integrating these skills into the curriculum, but is it too late. Have educators read from the beginning of the document and tried to implement the objectives written there before reading the back section where the ideas for integration may be written?

How did this problem originate? During the 1980s in the public schools, there was great emphasis placed on teaching all students programming skills and teaching about the computer. Most educators today believe that the computer literacy movement was ill-advised, at least partly because the arguments for its justification were flawed. One of those arguments was that students needed to know how to program computers in order to get and keep a good job. This reasoning was illogical, of course, for a variety of reasons. More accurately, programming was included in the curriculum because there was not much else to do with them at that time. Times have changed drastically, yet many educators continue to support the ideas of learning about the computer.

The authors of this article, along with others, believe that it is how we have students use technologies as tools for learning that is most important and that will better prepare them for their lives (and ours) in the next century.

It has been stated that 80% of the jobs that today's first graders will have when they graduate do not exist today. If this turns out to be true—or even close to reality—how can we determine what students today need to know about technology? As a matter of fact, how are we to know what they need to know about many topics? It is our premise that students need to be comfortable with using tools as problem-solving tools and information resources, and be able to make decisions after close analysis of the information gathered.

The Solution

While it may be appropriate for electrical engineering and computer science majors to pursue the computer as an object of study, it may be highly inappropriate for

K–12 students to approach technology in this manner if their goal is to learn how to use technology in their learning process. One doesn't have to know RAM from ROM to use a computer effectively in most disciplines. One doesn't have to know the role that Atanasoff played in the role of the development of the computer, interesting though it may be. In what (at least superficially) appears to be a paradox, as computers and technology become more complex, users in fact may actually know less, rather than more, about computers and other technologies.

Whenever a new technique or tool is introduced into an organization, the "old-wine-in-new-bottles" syndrome frequently occurs. The individuals in the organization have a tendency to bend the new tool to fit the old way of doing things rather than exploring or learning how the new tool might be used to perform additional tasks, including the use of higher order thinking skills instead of giving back information that has been memorized. While this approach may be an appropriate response under some conditions, it is an inappropriate response under most conditions. We do not have a curriculum for the pencil—why do we have curriculum for a computer? Aren't they both tools to be used in the learning process?

One of the major questions posed by teachers and administrators is "How do we fit computers into the curriculum without lengthening the school day?" If technology or computer education is viewed as a new area of study that must be taught in addition to the regular curriculum, then it is difficult to find the time for a computer program without shortchanging another area of study. But if computer-related activities are designed to support the regular curriculum, they won't distract from it, but may (many say will) enhance it.

According to the *Record to the President on the Use of Technology to Strengthen K–12 Education in the United States* (Panel on Educational Technology, 1997), workers in the next century will require not only a set of facts but the "capacity to readily acquire new knowledge, to solve new problems, and to employ creativity and critical thinking in the design of new approaches to existing problems"

Does today's curriculum match these needs? Will the future citizens of our country be the problem solvers and critical and creative thinkers that will be needed in the future? If not, we must make this type of curriculum available to the learners in our classroom today.

So Now What?

In many school districts, applications software is now taking the place of programming and almost everyone who learns to use it sees an immediate application in her or his own work—or do they? For those who do see this connection, the computer and other technologies become practical tools that teachers and students can use in all areas of education to enhance the learning/teaching process. Those who do not necessarily see the connection, teach the tool, not the use of it, in the learning process—as is evident in many technology curriculums throughout the United States.

A different approach to curriculum planning is to review each objective that is already in the school's curriculum and plan how technology can be used to enhance the attainment of those objectives. The rationale is that the technology is a teaching or learning tool and that students should learn with computers and other technologies when such learning/teaching provides some advantage over more conventional methods. One of those advantages is that students who use the technology in this way are using technologies similar to the way people in the world of work are using them—persons in business, industry, manufacturing, education, and the military are using technologies as tools to make them more productive in their jobs or professions.

Technology as a tool works best when learning includes the process of finding data, information, or artifacts; making decisions based upon data; and communicating those findings to others. Technology as a tool works best when teaching includes the management of a learning environment that sets up environments in which students can work individually and in groups in data collection, decision making, and communicating within the context of real-world tasks.

Examples

Educators might include some of the following activities using technology as a learning/teaching tool:

- Confer with colleagues and other experts worldwide via listservs and e-mail.

  Participation in listserv activities enhances lessons and classroom activities. Teachers can post questions on listservs such as Kidsphere, AERA, and EdTech and receive answers and additional information from experts in various fields of education.

- Manage instructional tasks.

  Educators, both classroom and administrative, can use spreadsheets and databases to collect data for students in the school. Word processing can be used to type, save, and print memos, letters, and activity sheets.

- Access, collect, and use data and instructional resources from the World Wide Web.

  Educators can access lesson plans that integrate the use of technology. Many can be found at AskERIC (http://ericir.syr.edu/Virtual/Lessons/), CSPAN Online (http://www.c-span.org/classroom/lessons.html), United Nations CyberSchool Bus (http://www.un.org/Pubs/CyberSchoolBus), CNN Newsroom (http://cnn.com/CNN/Programs/CNNnewsroom/daily), and Connections+ (http://www.mcrel.org/connect/plus).

- Prepare and use slideshows for presenting new problems.

  Teachers can model the use of presentation software while presenting information to the class. Students can then follow this model when presenting reports. In this way teachers can include the use of various media. For example, the educator could use a slide presentation that includes links to the Internet or Web sites that have been "whacked" from the World Wide Web prior to class time. (The software WebWhacker allows the user to "copy" the site by downloading it to a floppy or hard drive to be used offline at a later time.)

- Make assignments available electronically.

  One of the authors of this article uses the class listserv to send the class agenda and the following week's class assignments to the class members the day before class meetings. This gives students time to begin to think about the topic for the class and make sure they are prepared for the class. It also gives them time to have questions answered about the following week's assignment.

- Make provisions for students to hand in assignments electronically.

  Both authors of this article either require assignments to be sent electronically or give the students the opportunity to hand in assignments via e-mail or class listserv. This also can be used as a means for reflection and question posing/answering throughout the week.

- Consult expert consultants.

  Dr. Math (http://forum.swarthmore.edu/dr.math) can be used to pose questions to the experts at the Math Forum concerning many math issues. Other resources, such as educational listservs, can also be of assistance in answering questions concerning the many facets of education—from curriculum to classroom management to AUP policies.

- Access up-to-date information in a specialized field.

  Information concerning the national standards can be accessed at the click of a button using the World Wide Web. Mathematics standards can be retrieved at http://www.NCTM.org. State and some local curriculum can also be retrieved. For example, the Texas TEKS can be retrieved at http://www.tea.state.tx.us/teks.

- Stay informed on a topic.

  Teachers can use technology as a tool for their professional development activities. Resources, such as EduWeek, The Chronicle of Higher Education, Educational Leadership, Electronic Learning (http://www.scholastic.com/EL), and Instructor Magazine (http://www.scholastic.com/Instructor) are excellent resources.

- Participate in collaborative projects via the World Wide Web or e-mail.

There are many resources on the Internet that open classroom projects to those schools that wish to participate. At Collaborative Lesson Archive (http://faldo.atmos.uiuc.edu/CLA/index.html) educators can choose the grade level, the curriculum area and the collaborative lesson in which the want to participate. Educators can also post an idea they have for a collaborative project at this site.

Here are some examples of what students might participate in:

- Learn how to locate, access, assemble, and evaluate a wide range of data and resources in the student's area of study.

  A group of 18 high school students from Texas recently collaborated on a tour of the Historical Corridor project, taking field trips, interviewing local experts, and gathering information from local libraries, museums, and CD-ROM databases. They presented their findings in a multimedia presentation to their classmates as well as to classes across the state via videoconferencing (http://www.4teachers.org/testimony/johnson).

- Communicate with other students and experts, worldwide, in a particular field of study.

  A fifth-grade class from Nebraska communicated with a Nebraska National Guard team via e-mail as the team flew around the world. The unit's crew described the geography, history, and culture of the countries to which they flew. Students would send questions via e-mail. The classroom discussions were much richer as a result of the communication. They also used math and science skills as the Guard crew explained how they used math and science in their daily activities. Following the return of the crew to Nebraska, crew members visited the fifth-grade classroom and displayed stamps, currency, and newspapers from the countries they visited (http://www.4teachers.org/testimony/munn/).

- Access databases not otherwise available.

  As part of Link2Learn (a project developed by Pennsylvania Department of Education), middle school students are challenged to develop their problem-solving skills via science inquiry and data analysis. After visiting NOVA Online (http://www.pbs.org/wgbh/pages/nova/avalanche/previews.html), Avalanche Statistics (http://www.csac.org/Other/av-stats/), and Fatalities per Season (http://www.netway.net/caic/fatyear.gif), "students develop an hypothesis about why there might have been fewer avalanche deaths in the U.S. between 1988 and 1991." They use the data to explain their hypothesis and develop a report using a multimedia presentation tool.

- Access to a wide range and assortment of resources not easily available.

The wealth of information available on the Internet can be used to give students access to information not available to them before. The Guggenheim Museum (http://www.guggenheim.org/), the Louvre (http://mistral.culture.fr/louvre/louvrea.htm), and the Modern Museum of Art (http://www.moma.org) Web sites can be browsed by students around the world. The works of art can be studied, compared, and analyzed for techniques in common and variations in style.

Conclusion

A tool is not an end in itself, but a means to an end. Tools themselves do not teach; neither should they be the object of instruction. A tool is a means to an end, so it makes sense that technology as a tool should be integrated throughout the school's curriculum. In a technology-integrated curriculum, there is no need to add new technology-related objectives to a school's curriculum. Rather, schools should examine the traditional curriculum and determine when it may be appropriate to develop computer-related learning activities for existing curricular objectives or to use technology as a tool to prepare learners for a new unit or lesson. Students learn these skills in a relevant and useful context.

The ideas stated here will help today's educators become prepared to deal with the type of learning that must take place for our students to be ready for the next century. We believe that the activities mentioned in this presentation will begin to support the following suggestions from the Presidential Panel on Educational Technology:

1. Focus on learning with technology, not about technology.
2. Emphasize content and pedagogy, and not just hardware.
3. Give special attention to professional development.
4. Engage in realistic budgeting.
5. Ensure equitable, universal access.
6. Initiate a major program of experimental research.

We are in the midst of the Information and Communications Age. Our total collected body of knowledge is expanding so rapidly that most of us have difficulty staying up-to-date, even in our own fields of specialization. In this era, knowledge of facts is not as important as the ability to find information when it is needed, to analyze and synthesize it, and to apply the conclusions to new situations. With the technology as a tool, students can focus more on thinking.

General Session: Curriculum Design/Strategies

Catch the Connection (Classroom, Community, and Careers)

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Key Words: student projects, competencies

Motivated by creating a Web site for the Iowa Association of School Boards, students and educators dialoged and decided they could provide services to the seven communities (population ranging from 15 to 1,500) in their rural school district. As a result, members of these seven communities are active Internet users, creating global access to rural America. The backbone is the Prairie Valley Internet Services, a student-based Internet business, which not only includes computer support services and Web support for financial, agricultural, service, and business organizations but also supports state organizations such as the Future Farmers of America, Iowa Association of School Boards, and The Iowa Band Association.

Financed by school-to-work and based on a SCANS Report for America 2000, this model supports the five competencies of the SCANS Report. Presenters will discuss how they took the five competencies, teaching them in integration that reflects the workplace contexts in which they are applied. This supports the Goals 2000 model that the most effective way of learning skills is “in context,” placing learning objectives in a real environment rather than insisting that students first learn in the abstract what they will be expected to apply. Presenter will share how they transferred the five competencies to their specific model. A progression of skills acquisition and related competencies will be demonstrated. Validation of essential student learning will be demonstrated using examples of work, including Ready Level of Proficiencies, such as Interpersonal Competence, where students participate in management level meetings and problem-solving sessions with community leaders and local business owners.

Participants will be involved in a comparison between a traditional classroom and a SCANS classroom where students serve as partners and often leaders in negotiating and implementing learning-centered, interactive activities. Construction rather than instruction is the focus of this educational model that helps students prepare for the workplace in the year 2000.

Attendees at this presentation will be able to transfer this model into their teaching and learning environment to create better and more accountable schools. Extended learning opportunities using this model will be available through a Web site developed in conjunction with this presentation.

Poster Session

Supporting Classroom Instruction With Technology

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Key Words: ClarisWorks, Kid Pix, multimedia, one-computer classroom, slide show

In this traditional poster session you will see how Barnes Elementary School in Beaverton, Oregon, has successfully integrated technology into the classroom curriculum. Eric LeMoine, a former third-, fourth-, and fifth-grade teacher at Barnes, is now a building-level instructional technologist. He plans with classroom teachers to support existing curriculum with technology.

Technology should not demand new curriculum; rather, existing curriculum should be adapted to be supported by technology. All too often we look at the computers in our school and classroom, asking the question "How can we use this with our students?" Although the computer and related peripherals can be helpful to us, this is not the question to ask. We need to first look at existing curriculum and practices and then decide how technology can support what we are already doing. The question then becomes "How can we use this tool to support our curriculum?" This is a vitally important concept, and we need to embrace it in order for technology to be successfully integrated into everyday classroom practice. Only after we become accustomed to technology through familiar curriculum can we begin to use it to teach in ways we have never taught before. The technology program at Barnes is built around this premise: look at what you already do in your classroom in terms of curriculum and then apply the technology.

Barnes School operates primarily on the Macintosh platform and uses ClarisWorks, Kid Pix, and HyperStudio for most projects. In this poster session, Eric LeMoine will display and demonstrate curricular projects from K–5. Projects presented will range from the 15-minute Interactive Worksheet to an eight-week unit. All curricular areas will be represented. Many of our projects are multimedia rich, and we have worked out some very simple ways to capture and import sounds, graphics, and movies into our projects. Most of the project ideas are easily adapted to middle and high school.

Many examples of ClarisWorks and Kid Pix slide shows will be available for demonstration. If you are a classroom teacher and often wonder how you can use that one computer in your room, Eric can show you many ideas that have met with success at Barnes. Come by for lots of great resources and ideas!

Visit our World Wide Web page at http://www.beavton.k12.or.us/barnes/home.html to see a few examples of our technology projects.

Internet Poster Session

Teaching Teleapprenticeships: Frameworks for Using Technologies

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Key Words: teacher/professor productivity, teacher education, networks

New technologies can be used to create new educational frameworks for learning that go beyond the standard schooling paradigm. This Internet poster describes research and development efforts to investigate "teleapprenticeships," interaction frameworks that support learning in the context of remote practice.

The studies summarized here have focused on teleapprenticeships embedded in teacher education, exploring a range of different "teaching teleapprenticeships" in which education students at a wide range of levels have learned to become teachers within the context of teaching practice. Five kinds of teaching teleapprenticeships were studied: question answering and asking, collaborations, student publishing, Web weaving, and project generation and coordination. Different implementations of these frameworks are compared and contrasted to uncover important general features of successful network use, including the need for institutional support for new learner and teacher roles.

For more details, see the Teaching Teleapprenticeship Web site at http://www.ed.uiuc.edu/tta/.

Workshop

Building Virtual Museums, Online Exhibits, and Exploratoriums

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Key Words: Web design, education, virtual, museum, exploratorium

The World Wide Web provides a remarkable opportunity for schools and students to create online learning experiences and environments. This introductory workshop is designed to develop your appetites, challenge your inventive faculties, and inspire you to mobilize the folks back home to build something wonderful. We believe that young people, with your help, will help us invent and build entirely new models for exploration and discovery.

Just What Is a Virtual Museum? An Online Exhibit? An Exploratorium?

The answer, it turns out, all depends upon the pioneering work you will do with your students and school community when you leave this workshop.

Throughout the workshop we will explore this new frontier in communication. You will be asked to sift through a rich variety of Web sites and critique what others have built. In forming your own definition of what works and what doesn't work, you will be constructing a new vocabulary to talk about this medium as a Web designer and programmer.

Goals

By the time this workshop is over you should be able to:

1. Start constructing dynamic working definitions of "virtual museum," "online exhibit," and "exploratorium."
2. Start developing personal visions of what a school virtual museum, online

exhibit, or exploratorium might deliver in support of student learning and curriculum.
3. Further develop basic HTML and Web design skills learned in the workshop and required to construct a virtual museum, online exhibit, or exploratorium prototype.
4. Begin to identify strategies to engage a broad group of staff and students in the design, construction, and management of a virtual museum, online exhibit, or exploratorium.

Who Is the Workshop Designed for?

This workshop is intended for members of the school community and local cultural arts organizations interested in forming educational partnerships. All workshop participants should have solid computer skills. All participants should be:

- skillful using a mouse
- a competent Macintosh or Windows 95 user (able to navigate smoothly)
- familiar with either SimpleText (Mac) or Notebook (Windows)
- able to create new folders and document files, find folders and files, and save files to specific folders

Who Are the Workshop Designers?

This workshop has been designed by Jamie McKenzie and Laura Lewis. Laura comes from the arena of the cultural arts and education. She holds an M.A.T in Museum Education. Her most recent project was the creation of "At Home in the Heartland Online" for the Illinois State Museum and Illinois Public Schools. One of the first interactive online exhibits of its kind, "At Home in the Heartland Online" was designed specifically to be used in a K–12 classroom. Jamie is an expert in the arena of education and technology, having been teacher, principal, superintendent, and director of technology. Now an education consultant, Jamie lectures around the country on the subject of technology and schools. A prolific writer, he is both the editor and principle writer of the popular 'zine "FromNowOn."

Workshop

Teaching the Internet Without Blood, Sweat, Tears, or Lawsuits

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Key Words: Internet, tutorial, school

This session details a complete program of Internet instruction and control using your Web browser to teach e-mail and Web skills without an Internet connection.

As a school librarian given the task of granting Internet access to more than 1,000 students, Pat Lewis had to find a way to automate the teaching of Internet skills, provide supervised access to the Net, and at the same time avoid the legal problems that could result from unrestricted Internet use. To accomplish this, he and colleague Allen Armstrong developed a five-part plan for granting student Internet access. The plan addresses the issues of instruction, testing, acceptable use policies, supervision, and discipline.

Because Internet instruction poses the biggest problem for most educators, this session will deal extensively with two programs developed by Pat Lewis and Allen Armstrong. The program for Grades 8–12, the Information Superhighway Driver Training Course, was first introduced at the American Association of School Librarians Convention in Portland, Oregon, in March 1997. Bicycle Safety on the Information Superhighway, for students in Grades 4–7, was introduced at the American Library Association convention in July 1997. Running in whatever browser you have chosen to install, these self-paced Internet training courses put students in the driver's seat for a safe journey through the twists and turns of the information superhighway.

In the Web section, each CD-ROM has six active, captured Web sites with particular appeal to students. In this controlled setting, students learn to navigate the main roads—as well as the back roads—of the Internet and World Wide Web. In the e-mail section, students learn netiquette and the rules of the road, and master the use of one of three mail programs (Eudora Light, Netscape Mail, or Pegasus Mail).

Copies of helpful forms, including a simple, generic Acceptable Use Policy, a Student Internet Use Agreement, and an Internet Parent Permission Form, will be made available.

This presentation will bring together all five parts of the plan to introduce attendees to a complete, four-hour Internet instruction program that will allow them to get their students online without blood, sweat, tears, or lawsuits.

Internet Poster Session

The Project LITT Web Site: Hypermedia-Based Literature for Students at Risk

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Key Words: Internet, learning disabilities, at-risk, literacy, reading, literature, hypermedia

This Internet poster session introduces conference participants to the purposes and operation of the Project LITT Web site and answers questions related to the site's development. Project LITT, Literacy Instruction Through Technology, is a federally funded research project located at San Diego State University and sponsored by the U.S. Department of Education, Office of Special Education Programs. Its main purpose is the study of hypermedia-based children's literature programs and their effectiveness in improving the reading skills of students with learning disabilities and others at risk. These programs (sometimes called "talking storybooks") read the text of stories aloud to students. The stories are accompanied by colorful illustrations, and, in most programs, students can interact with both text and graphics.

The Project LITT Web site is divided into two sections. The first, Information about Project LITT, explains the project's purposes, describes the type of software under study, and discusses current research efforts. The second section, Software Profiles, is designed for teachers and other professionals who are interested in learning more about hypermedia-based children's literature programs. This part of the site presents detailed Software Profiles for more than 200 children's stories identified in Project LITT's 1996–97 software search. Profiles can be accessed in two ways. First, several lists are available to users (e.g., an alphabetical list of programs by title, a listing of programs available in languages other than English). Second, it is possible to search the Project LITT database for specific programs by language, readability estimate, text interactivity level, and level of interactivity with graphics.

Each software profile provides several types of information about the program: (a) title, (b) the software series to which it belongs, (c) the publisher, with World Wide

Web address, if available, (d) platform(s), (e) price, (f) age/grade recommended by publisher, (g) the length and estimated readability level of the print book accompanying the program, if available, (h) the length and estimated readability of the on-screen story, (i) language(s) in which the story is told, (j) summary of the story, (k) interaction modes for learners, (l) types of text interactions, (m) text interactivity rating, (n) types of graphics interactions, (o) graphics interactivity rating, (p) amount of animation in the program, (q) navigation through the program, (r) program features, and (s) description of the software series.

This site was constructed using HTML, FileMaker Pro, and Tango. Software profiles are stored in a FileMaker Pro database residing on the College of Education Web site at San Diego State University. HTML forms generated by the Tango software provide CGI-based searches and retrieval of database information. Profiles are then posted in HTML format.

Visit the Project LITT Web site at http://edWeb.sdsu.edu/SPED/ProjectLitt/LITT/.

General Session: Curriculum Design/Strategies

How to Manage Successful Use of Computers in Your Classroom

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Key Words: classroom computers, classroom management

Rationale

Classroom management issues are changing because many schools are now placing computers in classrooms rather than in computer labs. This shift in computer placement is intended to stimulate teachers to provide students with more real-life, hands-on activities. However, Sandholtz, Ringstaff, and Dwyer (1990) state that "instructional innovation is not likely to occur until teachers have achieved a significant level of mastery over management issues" (p. 2). A successful management plan for a classroom that integrates the use of computers should include:

The use of an instructionally sound rotation schedule that addresses what students will do before they go to the computer, while they are at a computer, after they finish computer work, and what they can do at any point during the lesson.

A Method for Solving Technical Problems

Assistance for students who need help with computer skills (Lowther, Bassoppo-Moyo, & Morrison, 1998).

Purpose

The purpose of this paper is to examine how teachers solve management issues for integrating technology in the classroom. This study addressed the following research questions:

- What rotation schedule was used to move students to the computers?

- What procedures or rules were used to manage student use of computers?
- Was equal access to the computers addressed, and if so, how?
- How were technical problems addressed?
- Did the teacher use "how-to" instructions to assist students with basic computer tasks?

Method

This paper reports on three ethnographic cases of classroom management of technology integration from a purposive sample in a large urban school system. The participants were teachers from one third grade, one sixth grade, and one middle school art classroom. Each classroom had four computers, one printer, and one instructor station with a large display monitor. Data were collected with in-depth interviews and classroom observations.

Results

The overall results indicate that teachers:

- used a variety of rotational plans
- were creative in their approaches to using technology and solving technical problems
- used more than one approach to assist students with learning computer tasks

Rotation Plans

The case study teachers indicated that there were two primary ways to rotate students to the classroom set of computers, as intact groups or on an as-needed basis. The intact group rotation involved small groups of students staying together as they moved from one activity to another, with one of the activities being the computers. With this type of rotation, the teachers indicated that it is important to make assignments about the same length of time. Teachers used kitchen timers or time keepers to indicate when it was time to move from one activity to the next. The as-needed method involved assigning groups to a specific computer. If more than one group was assigned to a computer, the students created a schedule for computer use and then completed various computer tasks during this allotted time.

Creative in Approaches to Using Technology

The teachers were creative in their approaches to using technology. Some of the techniques that the teachers used included: integrating multidisciplinary activities into art lessons, using a point system for earning or redeeming time at the computer, encouraging arrangements of small groups (pairs, groups of four) for specific computer activities, and writing job aids (i.e., brief "how-to" instructions) for performing routine computer tasks. All three teachers employed more than one of these methods, with the art teacher using the widest variety.

Solving Technical Problems

The case study teachers described several approaches that were used to solve technical problems. The more difficult problems were handled by their school's technology coordinator, fellow teachers with computer experience, or technical assistants at their district office. The teachers, themselves, had learned to solve the simpler computer problems, such as crashed machines, disks that would not eject, misplaced documents, and unresponsive keyboard or mouse. They learned these minor problem-solving skills by asking other teachers or librarians, reading computer manuals, or interacting with students in their classes. Some of the simpler tasks, such as how to reboot or eject a "stuck" disk, were taught to the students to increase their computer literacy skills.

Learning Computer Tasks

The teachers often used more than one approach to assist students with learning computer tasks. Some of the observed techniques included sequencing teaching of routine procedures for using the computers, employing student-created contracts for achieving behavioral goals while at the computer, structuring computer activities, up-skilling students (e.g., peer tutoring, buddy system, lab technicians, and teacher assistance), and monitoring time while at the computer. Both the third- and sixth-grade teachers were more structured in their approach, tending to rely heavily on organized activities, teacher-directed procedures, and peer tutoring. In contrast, the art teacher often used a process of self-discovery and experiential learning, in which the students developed their own individual reference aids for later use.

References

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Sandholtz, J.H., Ringstaff, C., & Dwyer, D. (1990). *Teaching in high tech environments: Classroom management revisited, first-fourth year findings*. (Apple Classrooms of Tomorrow Research Report Number 10.) Available online at http://www.research.apple.com/Research/proj/acot/full/acotRpt10full.html.

Poster Session

Technology-Enhanced Assessment and Parental Involvement

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Key Words: parental involvement, portfolio, assessment, World Wide Web

There is general agreement by educational researchers and professionals that parental involvement in their student's scholastic lives is important. Some studies have shown that this involvement is one of the most important predictors of success in school. Yet the composition of the typical American family is changing in ways that make that involvement difficult for parents and schools.

These factors include the high divorce rate that separates families, the tendency for family members to be mobile or live great distances away, children being raised by members of an extended family (grandparents, for example), and stepparents. Compounding the problem are schools moving toward portfolio-based assessment styles that are difficult to reproduce and share with people who cannot come to the local school and view the items in the portfolio.

This presentation will demonstrate how new technologies including personal Web serving, scanning, and HTML can be used to help overcome these problems. Portfolio material can easily be scanned and put on Web pages by teachers using low-cost, high-speed scanners so that parents and other relatives can view the pages from any computer with a Web browser. Free Web servers for both Macintosh and PC permit teachers to turn their desktop computers into Web servers with no additional costs or hardware. These Web servers can have hundreds of password-protected folders so private student work remains private while still being accessible to people who need to see it. New HTML editors that are both inexpensive and easy to use make creation of Web pages as simple as using a word processor.

General Session: Emerging Technologies

Wireless Infrastructure in Education

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Key Words: wireless, Koramonde, network, digital, spread spectrum, wireless LAN, wireless WAN

Wireless networks are gaining popularity in educational settings for a number of reasons. This presentation will explore those reasons, which include lower long-term costs, ease of troubleshooting, flexibility, mobility, no recurring charges, and avoiding dangerous environments.

Wireless networks have many advantages over their more traditional counterparts. Wireless Local Area Network, or LAN, products do not require low-voltage certified installers, for example, freeing schools to implement wireless solutions when and where they need to without hiring expensive outside contractors. Wireless LANs eliminate the need for cabling and thereby also eliminate the troubleshooting of that cable, the chance for the cable to be accidentally broken or cut, and the need to pull more cable to add more network outlets. In addition, wireless LANs easily pass through buildings that are difficult to wire because of physical dangers or challenges including asbestos, fiberglass, toxic building materials, underground crawlspaces, pressurized pipes, or other obstacles. In addition to physical dangers, many buildings are historic sites or designed in such a way as to render multiple wall and ceiling penetrations impractical or undesirable.

Wireless Wide Area Networks, or WANs, are almost always faster than leased-line options, generally starting at 2 Mbit per second and ranging up to 20 Mbit per second, with 4 Mbit being most common. Wireless WANs can operate over distances as great as 25 miles and free the operators from recurring charges often associated with leased lines. In fact, many schools implementing wireless WANs have found that there is a zero payback period with these products and cost savings begin immediately.

Both types of wireless networks are typically based on spread spectrum technology, which was originally designed for the U.S. military to be both difficult to eavesdrop on and difficult to jam. These characteristics ensure that wireless networks are secure—in fact, they are almost always more secure than wired networks—and that they are generally immune to interference that might plague traditional radio transmissions.

Learn more about wireless networking, or view this entire presentation at http://www.koramonde.com/.

Poster Session

Leading a Network: Guiding Growth

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Key Words: MIDI, music, music composition, distance learning

As network coordinator and trainer of the MIDI (Musical Instrument Digital Interface) project, Sandi has developed strategies for effective teacher training, peer mentoring, and multiple uses of technology for network communication. She observes what teachers in the network need as next steps and guides them as they self-determine the areas of growth and development.

Although the project is specifically a music and technology group, Sandi has served as consultant to other fledgling technology-based groups and schools. The strategies that have been developed with the network are generic and easily translate to other technology-based initiatives. Sandi is also studying and collecting data to help define some of the issues involved in effective teacher training in technology.

The Vermont MIDI Distance Learning Network has grown from a membership of 11 teachers since its inception in January 1995 to more than 75 teachers, professional composers, and preservice educators. These members in turn work with more than 5,000 students in Grades 1–12 creating musical compositions using technology as a tool. The entire process involves:

- creating an individual or group composition
- writing a description of the intent and requested feedback
- uploading files and description to the World Wide Web
- substantive critique by students, teachers, and composers
- subsequent revision of the work
- posting of revised compositions

In addition to sharing music compositions through MIDI files on the World Wide Web, the network has online threaded discussions, technical support, and real-time chats. In 1997, the focus of two of the real-time chats were conversations about creativity, inspiration for composition, and process as students and teachers shared work with 5 professional composers in The Netherlands, Paris, and New York City. This year the electronic conversations will include 13 living composers from locations across the United States and around the world.

The network seeks out expert resources in our content area (professional composers) to serve an online mentors and artists-in-residence. The group works at goal setting, evaluation, revision and change, and is striving to meet national and state standards.

Examples of the work of our MIDI project can be seen at http://www.Webproject.org/midi/. In addition, we have a password-secured site to which students and teachers upload their MIDI compositions for the purpose of critique and reflection. Examples of some work that has been revised as a result of the reflection and critique process can be viewed at http://www.Webproject.org/projects/.

General Session: K–16 Computer Science

A Recipe for Capturing and Maintaining Girls' Excitement Using Technology

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Key Words: girls, technology, retention

The technology gender gap still remains an impediment to the movement of women into engineering, science, and other fields that require the use of technology. Along with a lack of confidence, loss of interest, and weak peer group support, girls begin to develop negative feelings toward mathematics, science, and computing in their early, middle school years. Numerous programs have been designed to counter some of these factors, but few address the need to build a lasting sense of community within a curriculum that accommodates each girl's individual interest.

Background of Career Choices and Computing

For the last two years Career Choices and Computing: A Program for Young Women at the University of Minnesota (C^3) has offered one- and two-week summer technology camps. Its mission is to develop the confidence and skills necessary for self-directed exploration and self-paced learning of new technologies. C^3 is based on the following premises:

- technological fluency is a lifelong skill
- technological fluency develops over time

- girls have limited opportunities to gain technological fluency in schools and informal educational settings

- girls tend to associate a negative self-image with technological fluency

University professors, local classroom teachers, and undergraduate and graduate students collaborate on the design and implementation of the summer program. All camps include learning in high-tech labs, field trips, and follow-up events during the school year. Participants work in groups no larger than six under the guidance of a mentor/facilitator. Each session is headed by two master teachers who have extensive experience using technology in the classroom. Because the girls are encouraged to attend multiple years of the camps, the curriculum is designed to provide continuity of instruction for returning campers, while remaining individualized and flexible enough to accommodate new campers at each level. A measure of the success of this program is its retention rate—85% of the girls who attended the first (1996) sessions attended the 1997 sessions. Moreover, 50% of our participants attended the four, academic-year, Saturday follow-up sessions.

We are currently exploring the reasons for our excellent retention rate. It is our belief that the way in which the curricula is implemented to accomplish our goals is a major factor in attracting and retaining girls. The four building blocks of C^3 curricula are (a) community building/collaboration, (b) use of open-ended technologies, (c) student-designed projects, and (d) career awareness.

Community building

Thomas Lickona states that there are three conditions that need to be satisfied in order to create community:

- students must know each other

- students must respect each other

- students must feel responsibility to and ownership for the community

The C^3 camps for different age groups satisfy these conditions by having the girls participate from the first day in community-building activities, such as creating a list of how they are both the same and different from one another and developing a joint code of conduct. On the second day, they write and perform a skit to share unique characteristics of their working group. These activities encourage the development of friendship groups, which Jo Sanders states is essential in counteracting the "computing is male" message, as well as her observation that girls feel more comfortable learning technology when they are in a peer group that is doing the same. Moreover, girls in the two week seventh and eighth grade camp participate in activities that focus on building their respect for each other's learning and working styles.

Use of open-ended technologies and student-designed projects

The curriculum and pedagogical approaches used in C^3 allow students to examine science and engineering concepts in both a physical and virtual manner, using active learning to construct their own knowledge. By using computer programs, such as Lego Logo, MicroWorlds, 3-D Architecture and Landscape, and TesselMania!, participants can design projects with varying degrees of complexity. The motivation required to learn these programs comes from the girls' interest in working on their projects. For example, designing and programming an original computer game with MicroWorlds is more active and engaging than playing a commercial game. In the process, students de-mythologize and deconstruct their current ideas of what technology is and what it can do while developing a positive sense of self and self-mastery.

Career awareness

The advent of new technologies has brought with it new and untraditional employment opportunities that each camper becomes familiar with through an e-mail pal, that is, a woman working in a high-tech industry who communicates daily with her camper about her work and life; guest speakers; undergraduate and graduate student mentors; and field trips.

General Session: Curriculum Design/Strategies

Project-Based Learning and Simulation Design in the Science Classroom

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Key Words: inquiry, multimedia, project-based learning, science, collaboration, Logo, constructivist

Background

Since 1996, a research team funded by National Science Foundation, including a teacher at University of California—Los Angeles's (UCLA) University Elementary School and several researchers at UCLA's Graduate School of Education and Information Studies, have been investigating a constructivist learning environment referred to as "learning science by design." This classroom intervention integrates project-based learning, computer technology, and the upper elementary science curriculum. Over the course of work with three successive upper-grade science classes, the team has developed an instructional model and related Web site to share its insights and findings with the educational community. The Web site documents the team's reflections on student learning in a learning-science-by-design project, and serves as a practical template for other teachers to use and modify for their own unique classroom communities.

Description of a Learning-Science-by-Design Project

The learning-science-by-design model is based on the idea that students have greater opportunities to gain deep conceptual understanding when they engage in the design and construction of simulations to explain scientific concepts (Kafai, 1995). The instructional model has four integrated components in which students engage concurrently: learning of scientific concepts, student-centered scientific inquiry, computer simulation design to represent developing conceptual knowledge, and collaborative team work and learning.

In the learning-science-by-design project, students spend 10 weeks designing a simulation that must teach younger students important science concepts in topics areas such as electricity and magnetism, oceanography, astronomy, or human body systems. They use MicroWorlds Logo or any other programming language that allows for the development of interactive models and animation. Students do project work in collaborative teams, composed of four to five students of mixed gender and grade. While they are working on their simulations, student teams also develop and refine research questions that they investigate, and integrate new knowledge and understanding into their simulations. The teacher takes the role of learning facilitator in this student-centered environment, and provides lessons and other learning resources. The teacher also provides guidance in response to student research questions.

Description of the Session

In the session, research team members discuss implementing the learning-science-by-design model in upper elementary classrooms (Grades 4, 5, and 6), and share practical ideas for how to use and adapt this model. The following information is discussed in the session:

- overview and rationale for project-based learning and simulation design in the science curriculum

- a different instructional paradigm: Integrating the four model components in a student-centered, project-based environment

- charting a path: description of the 10-week learning intervention from start to finish

- focus on successful tools and techniques for: computer-based design and research; team communication and collaboration; student-driven scientific inquiry; project planning, reflection, and revision; sharing of limited technology resources; and assessment.

- recognizing individual differences: some gender issues associated with collaborative styles and technology access in learning-science-by-design projects

The research team has also developed a Web site designed to help interested teachers develop their own learning-science-by-design curriculum. Examples from the Web site are presented. These will highlight the following: templates for project activities; pictures and video clips to illustrate project components; samples of student simulation projects; reflective comments from students, the teacher, and researchers; research findings about student learning; and links to related project-based learning Web sites.

URL's referenced: KIDS (Kids Interactive Design Studio) http://www.gseis.ucla.edu/faculty/kafai/KafaiIntro.html (within this Web site, go to the section labeled "Teachers").

Workshop

Developing and Using Intranets in Schools: A Hands-On Primer

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Key Words: intranet, networking, telecommunications, curriculum design

This workshop will provide both an overview of the use of intranets in education and hands-on work designing intranets and intranet activities for education. The workshop focuses on the individual school, though district administrators and technology coordinators may also find the activities of interest.

The program will begin with an overview of intranets, including what they are, the difference between intranets and traditional networks, and the difference between having an intranet and having Internet access. This introduction will be followed by a description of the intranet currently in place at the Sageland MicroSociety School, including discussion of its use for administrative, technology coordinating, and curricular purposes.

For the bulk of the workshop, participants will design innovative uses and activities for intranets. There will be individual stations, or learning centers, for those interested in: designing an intranet; setting up administrative uses of intranets; using an intranet to relieve some common technology coordinator functions, such as installing software and troubleshooting; and designing innovative classroom activities using an intranet. These projects can include collaborative activities, distance learning within a school, within school publishing, and others. Participants will have the opportunity to work at more than one center.

These activities will be published on an intranet set up for the workshop, and all files will be given to the workshop participants to take back with them. Thus, all participants will go back to their schools with a site of already designed intranet activities. Tools to be used include: Quid Pro Quo Web server; FileMaker Pro 4.0 database; and Claris HomePage 3.0.

Workshop

Negotiating Global Issues With Other Schools in Your Classroom

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Key Words: Internet, social science, student centered, international simulation

The International Negotiation Project (INP) at Whittier College is the West Coast partner of the University of Maryland's International Communication and Negotiation Simulation (ICONS). ICONS began in the early 1980s, while INP began in the late 1980s, as tools for helping students gain a better grasp of the complexity of international issues. The simulation process is intended to encourage the development of information-gathering and assessment skills, critical thinking skills, a better understanding of the connections among contemporary international issues, and an appreciation of cultural differences in approaches to problem solving.

An INP simulation places students in the role of decision makers and negotiators on issues of international importance, such as international debt and development, regional security and arms trade, human rights and child labor, trade and international economics, and the global environment. Each participating institution is assigned to represent a single nation in the negotiation. Working together in "country-teams," participants model real-world international interactions between countries. The simulation is conducted on two levels: within the teams and between the teams. Within a team, students research their assigned country, and working as a group, formulate their country's foreign policy and negotiation strategies. The teams then communicate their policies and conduct international negotiations with the other country-teams. During the simulation, the country-team groups continue to meet to discuss strategies and responses to other teams' proposals. Although participants are encouraged to be creative in developing solutions to international problems, they are always bound by the interests and constraints of their particular countries.

The INP operates fall and spring simulations for high schools in the western United States. The INP is appropriate for one-modem classrooms as well as for schools with fully networked facilities. Because the INP is Internet based, only a basic knowledge of browsers (e.g., Netscape, Internet Explorer) is necessary. A teacher does not need to have more than a rudimentary understanding of computers and word-processing software to have a successful INP classroom.

Participation in an INP simulation allows students to:

- improve language arts and communication skills
- understand the interdependence of international issues
- appreciate cultural differences and approaches to world problems
- work in teams to solve problems
- use computers for accessing Internet information resources and communicating with other schools
- create and test negotiation strategies

Participation in an INP simulation allows teachers to:

- give students responsibility for their own learning
- develop more student-centered classrooms
- become facilitators of their students' learning
- emphasize the development of lifelong skills in their students
- create a classroom environment in which authentic assessment is possible and easily managed

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General Session: Curriculum Design/Strategies

Instructional Strategies on a Computer-Immersion Campus

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Key Words: technology integration, ubiquitous computing, electronic resources, communication, tools, demonstration/practice

This session will describe and demonstrate four categories of computer-enhanced instruction at a college that requires a laptop computer for all students.

This is a report of a computer immersion program at a small liberal arts college. All students and faculty have laptop computers and use them extensively. One challenge in this initiative has been to integrate the technology into curriculum design and teaching strategies. This presentation will give an overview of the implementation of use of the computer in instruction across campus. Specific examples will be described and demonstrated in the following categories.

Accessing Electronic Resources

Web Pages and Lotus Notes are used extensively to share course materials. We have developed templates to facilitate faculty posting and student use. Examples of Course Web Pages and Notes cabinets will be shown. A number of different disciplines are involved in use of *World Wide Web resources* as an integral part of courses. An example is politics, for which the Web is used to access foreign newspapers and other resources.

Several departments are developing *multimedia digital libraries*. In the digital format, materials are easily accessed by faculty and students. In art, religion, and history, online databases are available to assist students in using primary resources. In physics, a collection of online video laboratory demonstrations are being developed.

Communication

Many courses have an *online discussion* component. These are implemented by e-mail-based listservs, local newsgroups, or *Lotus Domino*-based discussion groups. For example, philosophy students may be required to discuss readings and/or lectures online. Composition courses rely heavily on Lotus Notes to provide a vehicle for *collaborative writing* and editing. *Presentation Software* is widely used. Instructors use PowerPoint during class and also may post lecture notes online before or after class.

Tools

Word processing is required in all courses. We have a campus site license for Office 97, and student papers may be submitted either online and on paper. *Number crunching* is required in several courses. Mathematics, science, economics, and other departments heavily use spreadsheets, statistics software, and symbolic algebra programs, such as Maple, for arithmetic/mathematical computations, including graphing. The sciences use computers for data collection and analysis in their laboratories. Education students use HyperStudio to develop multimedia personal portfolios.

Demonstration/Practice

There are also a number of discipline-specific applications that are used for demonstration and practice. Textbooks and ancillary materials are often CD-ROM *multimedia* format. *Computer simulations* are used by several departments. Classroom simulations are used in education. The music department uses a digital music laboratory to teach music theory and composition. Language Labs for individual practice in French and Spanish are increasingly computer based.

In conclusion, this presentation will give a rich overview of computer-enhanced learning activities in a college context. Each of the 12 underlined activities above will be demonstrated and discussed. This will be useful for many other educators in envisioning and designing curriculum integration strategies.

General Session: Curriculum Design/Strategies

Authentic Assessment of Computer-Mediated Conferences

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Key Words: authentic assessment, computer-mediated communication, constructivism

Abstract

Collaborative and constructivist learning activities using asynchronous telecommunication software, such as listservs, electronic bulletin boards, or groupware, have proliferated in classrooms in the last few years. A problem facing the classroom teacher wishing to take advantage of computer-mediated communication is assessing the contributions made by a student toward advancing or completing a project. Traditional measures of student participation in a computer-mediated conference include the number of times a student logs in, the number of messages left, the average length of a student's message, or the amount of time spent in the conference. While these measures are indicative of a student's participation they do not always provide a complete picture of a student's contribution to the group. Techniques drawn from social network analysis and graph theory help provide a more complete description of the interactions of a group using computer-mediated communication. This session will demonstrate how these tools, when used in conjunction with traditional measures of conference participation, can contribute toward the authentic assessment of a student's productivity in a computer-mediated conference.

General Session: Curriculum Design/Strategies

I.B.E.C. - Internet-Based Educational Curriculum

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Key Words: cyberschool, distance, education, online, courses

The North Dakota Division of Independent Study has been delivering high school courses to students for more than 60 years. Now the fourth largest K–12 distance education institution in the United States, the division offers more than 150 courses to students all over the world. Currently 8,200 students from all 50 states and 23 foreign countries are enrolled in division courses. The division is certified by the North Dakota Department of Public Instruction and the North Central Accreditation Association to offer a high school diploma to students from every part of the world.

Online courses are not new to the division. Russian I was placed on the Internet in 1990 using a state network of NeXT computers. In 1995, the first out-of-state student enrolled and complete Internet-based World Geography I. The division's World Geography II was awarded the 1997 Meritorious Course Award from the University Continuing Education Association's Independent Study Division. Twenty Internet-based courses are now accessible from the division's Web-server.

This session will focus on three areas related to distance education delivery using the Internet.

First, a general overview of current organizations that are involved in delivering distance education using the Internet. Participants will view various course offerings and styles of course presentation. Special attention will be placed on textual, audio, and video methods of delivery.

Second, participants will view current course offerings available from the North Dakota Division of Independent Study. Curriculum development, integration methods, and hypertext design will be discussed. The discussion will also include past and present concerns and problems with Internet-based course offerings.

Third, the results of an External Diploma Program pilot project, authorized by the American Council on Education, will be shared. The pilot project is designed to provide older-than-average adults the chance to complete a high school diploma. Competence-based curriculum materials used in the pilot project are self-paced to meet the needs of work schedules. Student evaluations are done by means of Internet teleconferencing.

Participants in the session will leave with an understanding of what is being done in the area of Internet-based course delivery. They will see the possible applications that exist for their current situations and the possibilities of what the future can hold.

Workshop

Mini-Bio Book: Make a Book With One Piece of Paper and ClarisWorks

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Key Words: ClarisWorks, frames, drawing, painting, layout, biography, design, bookbinding

The best way to learn computer tools and technique is to make a real project. Through the magic of origami paper folding and one cut, your one-page ClarisWorks draw document (complete with text and paint frames) turns into a snappy eight-page book. This little book project achieves many goals. First and foremost it gives students a real workout with ClarisWorks frames—drawing, painting, and word processing frames on a draw document. Layout principles, both artistic and those relating to computers, are the cornerstone of this workshop. One cannot do this project if type and pictures aren't rotated, page set up isn't switched to landscape, and margins aren't set up properly. The outcome is a very good product that shows that the student understands the concepts of layout and frames. I have watched students suffer through the hard technicalities of working with frames to get their little book finished. Something they would not have done so happily if there was not that great prize at the end of their travail.

The Shape of the Page

The book project stretches the imagination and changes the perception of the printed page. Yes, this project uses the 8.5 by 11 page but the page is folded and cut, and is horizontal instead of vertical. That the paper can be manipulated is a revelation to some students, adult and child alike. The manipulation of the paper in this case reveals a charming little book. I have found in my teaching that the more finished something looks, the better students respond to the lesson. A series of drawings, for example, that is bound seems to give the student a sense of real accomplishment. In the ethereal world of computers, just printing gives a more concrete sense of achievement.

In the busy day of teachers, binding 25 or 30 books is time consuming. To make a multipage book that the kids can fold themselves adds to the quality of the project. Printing only one side of the paper saves time, too.

The Shape of Content

But let's face it, form isn't enough, even if it is unique and very cute. A book has to be about something. I have chosen biography for several reasons. I use this book as a brochure for the workshops and lectures that I teach, a kind of biography. Kids, actually all of us, are most interested in themselves—a subject matter for a lesson that can't fail. In my classes of photo manipulation, many of the students extend the concept of self to include their families. One student resurrected a decaying civil war photograph. It is a short hop to understanding the concepts of biography. A student can go outside the known (self and family) and research the lives of others—historical figures, current celebrities, and literary lives. The form of the book, its small size, permits and demands that the author boils down the information to essentials. Form and content merge and become inseparable.

Workshop

The Web Isn't Print: Preparing Photos for Web and Print

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Key Words: digital imaging, computer photography, printing, Web graphics

What looks good on your computer screen doesn't necessarily look good when you print it. A high-resolution photo that looks wonderful when printed is a waste of disk storage and time if the photo is only going to be viewed on the Web at 72 dots per inch. A large file with a high resolution may also take an eternity to open on the Web. Conversely, a photo that looks crisp and clear on the Web may print blotchy and blurry. Much of this workshop will be spent to get students to understand the differences between photos on the Web and photos in print. The complicated technicalities of resolution, depth, and image size will be made clear through hands-on exercises.

Avoiding Mistakes

In my art business one of my clients sent me 8" x 10" grayscale photo of himself that was scanned in millions of colors. Not only was it a very big file that took a while, a very long while, to open but it created a greenish tinged skin tone that was unpleasant at best. Changing it to grayscale created a more useful photo for the Web, and it looked better, too. Another client sent me a signature for a Web page that was scanned at 1,200 dots per inch. At least it was in black and white! Do you have any idea how large the dimensions of a two inch signature are on screen if it has been scanned at 1,200 dpi! It ran across the width of the whole screen. And what should have been a 10K document, was well over 800K. People in the class will learn how to avoid these mistakes.

Imaging Magic

Basic imaging techniques are useful to both Web and printed photos. Most raw (scanned or digital) photographs aren't as good as we really need them. Almost all of them need tweaking of one kind or another. It is even sometimes possible to make a bad photo good through the magic of digital editing.

Worth the Look

In either case, print or the Web, it is always a struggle to find the perfect file size. On the Web, a picture that opens before the viewer goes to another page is a step in the right direction. In print, a photo that will print is a cause for celebration. However, there is more to digital photography than technical considerations. In both cases the photo has to be good so that when it does open quickly or is printed, it will be worth the look.

"Worth the look" can mean that the photo can have an interesting composition. Has extraneous information been cropped out? Is there a parking meter growing out of your head? Is it fuzzy? "Worth it" can also mean that the photo is illuminating. A combination of photographs can make flights of fancy that express a meaning that could not be conveyed by truth. Is irony or symbolism used? "Worth it" means that the image communicates something that words cannot. The purpose of the class is to make the students better visual communicators, whatever mode of communication they are using—the Web or the printed page.

Workshop

CD-ROM Design and Production in the K–12 Classroom

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Key Words: CD-ROM design and production

This three-hour presentation will provide insight into the process of CD-ROM development for the K–12 classroom.

Initially, participants will be introduced to academic CD-ROM projects completed by students in Multimedia Design, a one-semester course in which students develop CD-ROMs related to the academic curriculum. Projects completed by the 11th and 12th grade students include "A Tour of Baltimore," "Lotteries and Gambling," "Understanding the 60s," "Evolution of Music," and "The College Process."

Next, participants will acquire an insight into crucial applications used in CD-ROM development, including Adobe Premiere, Illustrator, Photoshop, and SoundEdit 16. Participants will be provided numerous images, movie files, and sound files to manipulate using the above-mentioned software.

Approximately 1.5 hours will be dedicated to designing a simple Macromedia Director movie projector, which will incorporate many of the image, movie, and sound files manipulated earlier in the day. Macromedia Director is one of the leading multimedia design applications available.

The session will conclude with a demonstration of the CD burning process and continued discussion on the applicability of CD-ROM development for the K–12 classroom.

Students in the Multimedia Design course operated within a block schedule of 50 classes of 70-minute length. In addition to instruction provided regarding technical development, each CD-ROM was designed under the additional guidance of a faculty mentor who oversaw the academic content of the specific project.

Poster Session

Cyprus's Bridge to the World

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Key Words: Internet, Cyprus

The presenters will discuss the current educational uses of the Internet in Cyprus. They will propose a plan to propagate its use by educators and academic institutions, such as establishing World Wide Web clearinghouses to disseminate educational materials, developing collaborative projects between students from different regions, and building the infrastructure to support such tasks.

Cyprus was first introduced to the Internet in 1990. Today, five Internet Service Providers along with the University of Cyprus provide access to the Net for a large number of people on the island. World Wide Web, electronic mail, FTP, Telnet, and access to networks and institutions around the world are the most widely used Internet tools by students and educators. The use of such tools in their everyday activities yields tremendous benefits for the island's academic sector, such as exchanging ideas and sharing information.

A number of tertiary institutions, such as the University of Cyprus, the Cyprus College, and the Cyprus International Institute of Management, participate in the SOCRATES Project, a European Union action program in education that uses the Internet in delivering distance education courses. Furthermore, public elementary, secondary, and vocational schools under the Ministry of Education and Culture are involved in a number of projects, such as the South Eastern Mediterranean Sea Project (SEMEP) and the Web for Schools Program.

The use of the Internet in Cyprus is a pioneering step to bridge the island with the rest of the world. There is no doubt that Internet-based networking will play a significant role in the future for the people of Cyprus. As telecommunication costs decrease and technology rapidly expands, the use of the Internet will be both a challenge and an opportunity for students, educators, and entrepreneurs in acquiring the necessary tools for succeeding in the 21st century.

Workshop

An Educational Technology Organizer: Supporting World-Class Student Achievement

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Key Words: planning, standards, student results

The White Plains School District and the National Center on Education and the Economy worked together to develop and implement a method of organizing technology in schools that goes to the heart of what schools are about—getting all students to high levels of achievement.

Many recent national and local articles point out all the ways that computers have not "fulfilled" their educational potential. We may want to dismiss the criticisms with easy excuses, but if we think about the issues that are raised, and think about them without whining or raising our defenses, then we can honestly say that these articles make many valid points. We would agree that we have not done a good job of presenting the issues to the public. Nor have we done a good job of organizing the computers to make positive educational changes.

We need to have a clear consensus as to what the word "effective" means and what it will take to achieve it. It is when the learning environment changes that student learning changes. When teachers use the tools to engage children in active construction of knowledge, projects that are related to standards for learning; and when instruction, curriculum, and assessment are tied neatly together, then learning occurs.

What we know from so many other educational areas is that the way for computers to make a difference in children's learning is when they are organized to do just that. In White Plains, we identified measurable goals for the use of computers, determined what was to be learned, provided training and time for teachers to understand how best to reach these established goals, and then provided the support to carry out the plan. Before we connected to the Internet, before we publicly displayed our student-to-computer ratio, we evaluated the purpose in terms of student learning.

For computers to be worth the time, money, and energy to place them in classrooms, learning goals would drive their use.

The White Plains School District spent two years in public planning for the implementation of networked computer technologies in the schools and in the city. What sets White Plains apart is the meticulous manner in which they set out to ensure that the investment of dollars and of time would result in gains in student learning. White Plains makes it clear to students, staff, parents, and community that there is a direct link between the technology program and the districts educational goals.

General Session: Curriculum Design/Strategies

Physical Education Instructional Technology for Improved Learning

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Key Words: physical education, physical education software

Technology Assisted Instruction refers to student interaction with the computer or some other piece of technology to enhance the learning process. Devices that assist with the physical education instructional process include heart monitors, which provide visual feedback of heart rate; body composition analyzers, which compute percent of body fat; and electronic blood pressure machines, which automatically calculate blood pressure. In addition, software is available to assist the learning process in physical education.

Computer software programs, such as MacBowling Tutorial and MacSoftball Basic Defense, allow students to progress through tutorials and then answer questions on the material. Orienteering and MacFootball Rules Game provide students with simulations that require the use of higher level thinking skills. Family Health Book and A.D.A.M. Essentials are reference software programs that provide students with resources for projects. The next evolution of software will be virtual reality. During the session, several quasi-virtual reality systems will be discussed and shown through the use of video. Listed below are several pieces of software that are excellent for use in physical education:

- A.D.A.M. Essentials (A.D.A.M. Software)—high school version of interactive anatomy program
- A.D.A.M.: The Inside Story (A.D.A.M. Software)—secondary school program on all systems of the body
- An Olympic Journey: The story of women in the Olympic Games (Amateur Athletic Foundation)—women in the Olympics
- Body and Mind (FLD)—helps students assume personal responsibility for their own fitness-related decisions
- Family Health Book (IVI)—provides information on growth and development patterns
- Golf Tips (Diamar)—overview of playing golf
- How Your Body Works (Mindscape)—overview of the systems of the body
- Let's Play Tennis (ESPN)—covers the mechanics of playing tennis
- MacBowling Scoring (Fitware)—teaches/reinforces students' understanding of scoring for bowling
- MacFitness Report (Fitware)—fitness reporting software for fall and spring fitness testing
- MacHealth-Related Fitness (Fitware)—knowledge base covering all the FITT

concepts

- MacPortfolio (Fitware)—provides a template for students to monitor progress toward the eight subdisciplines of physical education (exercise physiology, motor learning, biomechanics, sociology, historical perspectives, psychology, aesthetics, and growth and development)
- MacSoftball Game (Fitware)—teaches/reinforces students' understanding of softball rules
- MacSoftball Basic Defense (Fitware)—teaches/reinforces students' understanding of softball defense
- MacVolleyball Complete (Fitware)—information on volleyball from the perspective of all eight subdisciplines
- Measurement in Motion (Learning in Motion)—analysis of movement using biomechanical principles
- Mountain Biking (Media Mosaic)—complete guide to mountain biking
- Rock Climbing (Media Mosaic)—complete guide to rock climbing
- The Total Heart (IVI)—comprehensive guide to heart health and heart disease
- Virtual Pool (MacPlay)—billiards simulation
- 1996 U.S. Olympic Team (Archimedia Interactive)—coverage of the 1996 Olympics

There are three steps for using instructional technology. The first step is to identify your instructional objective (these should be linked to the National Physical Education Standards). The second step is to select the appropriate hardware and software to best assist student learning in terms of the objective. And, the third is to incorporate instructional technology into the lesson. Physical education classes are typically large and usually have only one computer. For a lecture presentation, the computer is attached to a 25" television monitor or to a projection system that displays the screen image large enough for the entire class to view. The class members take turns reading the tutorial part of the software. During the question-and-answer phase of the program, small groups can discuss and answer the questions appearing on the screen. Another way to use the computer is in a rotation system during regular class periods. Students in small cooperative groups rotate from skill practice to a computer with which they review the material, answer the questions, and participate in simulations. Another station might even be a videocassette player where students observe model performances of the skills they are practicing or a video camcorder so that the students can videotape themselves performing the skill(s) for immediate feedback. As software is developed for the new eMate 300, these small student-based computers will be excellent for instructional purposes in physical education.

Vendors

Publisher	**Phone Number**
A.D.A.M. Software	800.755.ADAM
Amateur Athletic Foundation	213.730.9696
Archimedia Interactive	214.880.9090
Diamar	206.340.5975
ESPN	800.269.2101
Fitness Lifestyle Design (FLD)	800.FLD-INCL
Fitware	562.924.0835
IVI Publishing	800.952.4773 or 800.754.1484
Learning in Motion	800.560.5670
MacPlay	714.553.3530
Media Mosaic	800.97.CD-ROM
Mindscape	415.883.3000
Sport House	310.695.1885

General Session: Curriculum Design/Strategies

Found Sounds: The Bridge Between Physical Space and Cyberspace

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Key Words: found sounds, synthesized sound, instruments

Question #1 What to Expect?

I like to think of the computer as just one of a suite of toys for the creative exploration of sound. Hence in this workshop you will focus on the discovery and exploration of real-world sounds, which you will then process with the computer for use on Web pages.

The workshop will be divided into two sections. The first section is the activity-based or offline portion of the workshop. In this section you will be introduced to a number of simple homemade instruments that you can create and play with your students. You will also explore some ideas for playing these instruments in groups.

At the end of the offline portion, you will step through the process of sampling and preparing real-world sounds for introduction into Web pages.

The second section is the lab portion. For the sake of expediency, you will be provided with some pre-sampled sounds for use in the lab. In this part of the workshop, you will introduce these pre-sampled sounds into Web pages.

Question #2 Is It Real or Is It Synthesized?

To better understand the distinction between synthesized sound and sampled sound, consider the difference between creating an illustration with a paint program versus using a graphics program to manipulate a scanned photograph to create some final artwork. In the latter case, the image in the photo (let's say that of a tree) may be sufficiently processed that the output is indistinguishable as a tree, but you began your creation by photographing a real-world object. In the case of the illustration, the process began with an interaction with the computer.

In the world of electronic music there are synthesized sounds, which are generated by the internal workings (oscillators, filters, etc.) of some machine. In this case there is no piano, violin, or conga drum as the sound source. The machine, be it an early analog synthesizer or a modern computer, is the source of the sound.

But current technology also provides the opportunity to take a digital snapshot of some real-world sound. This might be the sound of a piano, a violin, or the sound of the wind blowing through the tree you photographed earlier. As with the photo of the tree, you can manipulate these sampled sounds to create sounds that are virtually indistinguishable from the original source sound.

Question #3 So What?

Sampling sounds from the vast symphony of sounds in the world around you can provide you with a far richer sound pallet than is typically available without expensive sound boards and/or synthesizers.

It also provides you and your students the opportunity to make and play instruments together offline, and then share what you've discovered, through such media as the World Wide Web.

Poster Session

The AskERIC Service: Technology Enabling Educational Communication via the Internet

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Key Words: Internet, AskERIC, ask-a-service, lesson plans, AskERIC InfoGuides, ERIC

AskERIC is a personalized Internet-based service providing education information to teachers, librarians, counselors, administrators, parents, and others throughout the United States and the world. It began in 1992 as a project of the ERIC Clearinghouse on Information and Technology at Syracuse University. AskERIC is a Sun SITE repository, which enables it to expand the quality and quantity of its resources and services to the education community.

AskERIC Comprises Three Major Components

AskERIC Q&A Service: Anyone needing information on the theory or practice of education can send a message to the AskERIC Q&A Service. AskERIC information specialists, drawing on the vast resources and expertise of the ERIC System, will respond within two working days with ERIC database citations, Internet resources, and, when appropriate, full-text ERIC Digests. Information specialists strive to provide personalized attention and resources that are tailored to users' individual information needs. To request education information, address an e-mail message to: askeric@askeric.org

AskERIC Virtual Library: The AskERIC Virtual Library is an Internet site showcasing selected education resources. By working closely with the Q&A Service, developers of the AskERIC Virtual Library have been able to reflect user needs and interests. Resources include:

AskERIC InfoGuides: 125+ topical guides to Internet, ERIC, and print resources. Sample topics include:

- Assessment of Technology in Education
- School to Work
- Young Adult Literature

Lesson Plans and Curriculum Units: 1200+ files, featuring:

- Lesson Plans Submitted by Teachers Across the United States
- Newton's Apple Educational Materials
- Crossroads: K16 American History Curriculum

Education Listserv Archives: Searchable archive of 20+ listservs, including:

- ISED-L: Independent School Educators List
- K12ADMIN: K12 School Administrator Discussion
- LM_NET: A Worldwide Discussion Group for School Library Media Topics

ERIC Database: Easy-to-use search interface through the World Wide Web using PLWeb/Personal Library Software.

Access the AskERIC Virtual Library with Netscape Navigator, Microsoft Internet Explorer, Lynx, or other World Wide Web client at http://www.askeric.org/.

AskERIC R&D

The AskERIC Research and Development team was formed to keep AskERIC on the cutting edge of technology. R&D's mission is to investigate educational use of high technology and high-performance networking. Current projects include using Time Warner's Palace software to develop a graphical MOO (Multi-user Object Oriented) environment for disseminating information, and creating customizable interfaces to the AskERIC Virtual Library. Partners include Sun Microsystems, Northeast Parallel Architectures Center, and Personal Library Software.

For more information about AskERIC, please send e-mail to askeric@askeric.org

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Poster Session

GEM: One-Stop Any-Stop Access to Educational Materials on the Internet

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Key Words: Internet, educational materials, lesson plans, GEM

The Gateway to Educational Materials

The Gateway to Educational Materials (GEM) is an initiative of the U.S. Department of Education and National Library of Education (NLE). NLE's goal is to improve the organization and accessibility of the substantial, but uncataloged, collections of educational materials that are already available on various federal, state, university, nonprofit, and commercial Internet sites. In general, these valuable resources are difficult for most teachers to find in an efficient, effective manner. The goal of the Gateway to Educational Materials (GEM) project is to solve this resource discovery problem and to provide The Gateway to these quality collections of educational resources.

A teacher connects to The Gateway and is able to access the Internet-based educational resources of the participating GEM Consortium members. Because teachers are accessing a database of records, locating the resources that they need is faster and more efficient than using the Internet search engines, which often result in hundreds of irrelevant hits.

Once teachers access The Gateway, they are able to:

- browse through lists organized by subject, key words, or grade/education level
- search by subject, keyword, title, or the full-text of the resource's catalog record
- go directly to the full-text resource from the catalog record

As of February 1998, The Gateway includes records for resources from the AskERIC Virtual Library, Eisenhower National Clearinghouse, Math Forum, Microsoft Encarta, North Carolina Department of Public Instruction, and U.S. Department of Education.

The URL for The Gateway is http://www.geminfo.org/Catalog/start.html.

Future Developments

The GEM Project completed Year One in September 1997, which involved establishing and developing the architecture, software, and training materials necessary to build and maintain The Gateway. Year Two includes continued improvements to software and training, establishing membership criteria and a governance structure, and soliciting high-quality collections for The Gateway to Educational Materials project.

Future enhancements are based on ongoing research and evaluation of what teachers want and need, including:

- additional access points to resources, such as the ability to search by state and national curriculum standards
- a personalized interface for The Gateway that allows for customized access by educators
- the ability to access The Gateway from your favorite GEM Consortium member site

For More Information

For more information about the GEM Project, contact Nancy Morgan, GEM Coordinator; e-mail: nmorgan@iis.syr.edu, or visit the GEM World Wide Web site: http://www.geminfo.org/.

Organizations with Internet-based educational resources that are interested in joining the GEM Project should contact Carrie Lowe, GEM Representative; e-mail: calowe@iis.syr.edu.

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Internet Poster Session

Teaching With Technology: Virtually Another Dimension

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Key Words: Internet resources, electronic syllabi, elementary education, college course, teaching, learning, Internet publishing

The Internet has added a fourth dimension to our three-dimensional world. It has changed how we function as we hyperlink in cyberspace with virtual communities and simulated experiences. It has changed how we communicate and learn. Telecommunication networks provide a means of dissolving the physical, social, and metaphorical walls of the school classroom allowing learning to take place anytime, anywhere, and with anyone. It also offers educators a new medium for organizing their teaching, extending curriculum, motivating students, resource building, and presenting information.

First-year elementary education students at the University of Vermont are required to take Computers in the Elementary Education Classroom, a course preparing them to use technology in their learning as college students and future educators. Course information and resources are electronically based on the Internet, permitting present and prospective students the opportunity to view syllabi, objectives, requirements, and readings in an electronic medium (http://www.uvm.edu/~jmorris/course.html).

Motivating students is just as important at the college level as it is in the K–12 classroom. The Internet is the world's largest bulletin board, a place to show off exemplary student work, as well as offer models and resources for the larger educational community. Student products presently include a gallery of dream houses, dream classrooms, and schools (http://www.uvm.edu/~jmorris/dream.html); reviews and critiques of educational software (http://www.uvm.edu/~jmorris/software.html); and links to related teaching themes (http://www.uvm.edu/~jmorris/currsites.html). The quality of students' work has steadily improved with concrete exemplars to examine and the prestige of having their work selected for display. Examples of student-developed Internet publishing can be viewed at http://www.uvm.edu/~jmorris/students.html and http://www.uvm.edu/~hbucklan/.

Students may need little encouragement to use the Internet but need direction in identifying and assessing useful educational resources. Students complete a site evaluation and as they discover commendable sites, their addresses are published as pointers and can be found as science resources (http://www.uvm.edu/~jmorris/Sci.html), Vermont resources (http://www.uvm.edu/~jmorris/keypal.html), elementary education resources (http://www.uvm.edu/~jmorris/ElemEdu.html), or organized as pointers by subject area (http://www.uvm.edu/~jmorris/pointtable.html).

Portable technology and the growing availability of network connections offer a new media for student and faculty presentations. Internet extends the audience and offers multimedia capabilities and linking to external resources. Some examples of Internet-interactive presentations are: Around the world in 80 minutes, (http://www.uvm.edu/~jmorris/vtfest.html), Ten Ways to Use Technology in Your Teaching (http://www.uvm.edu/~jmorris/hied.html), and Internet, the Newest Frontier (http://www.uvm.edu/~jmorris/VtFest97.html).

Internet sites are never complete but evolve to reflect the changes they sometimes initiate. Students are currently publishing standards-based curricula units, stories of their telecommunication project experiences, and helping neighboring schools publish Internet sites.

The Internet has invigorated and improved student learning as well as provided a tool to use in their organization and teaching. The Web has virtually added another dimension to education, one where students' can communicate, access, and generate information, as part of the cycle of learning, regardless of place or time or space.

Workshop

Project-Based Learning Using Information Technology

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Key Words: project-based learning, information technology, constructivism

Project-based learning (PBL) is used in many schools and by many different teachers. It is not surprising that the use of PBL is growing because PBL has a high level of authenticity. It tends to be obvious to students, teachers, parents, and others that PBL has many adult-world characteristics and can bring concrete purpose and meaning to a wide range of school subjects.

Information technology (IT) brings new dimensions to PBL. This workshop focuses specifically on IT-assisted PBL. Some characteristics of a good IT-assisted PBL lesson include:

- is learner centered
- has authentic content and purpose. Information Technology is part of the content and purpose.
- is challenging
- produces a product, presentation, or performance. IT may be a critical vehicle in the product, presentation, or performance.
- involves collaboration and cooperative learning
- allows incremental and continual improvement
- is teacher facilitated
- is designed to help students meet explicit educational goals
- is rooted in constructivism

Many teachers feel that PBL is an important and effective part of their teaching repertoire. There is a growing body of research literature underlying the use of PBL and the design of effective PBL lessons. The workshop will examine this research literature, and it will contain a detailed analysis of the steps that a teacher might followed in creating a good IT-assisted PBL lesson.

PBL can be used in all subjects and at all grade levels. A PBL lesson in an IT environment can be viewed as:

- an opportunity for students to learn in an authentic, multidisciplinary environment
- an opportunity for students to learn how to design, carry out, and evaluate a project that requires sustained effort over a significant period of time
- an opportunity for students to learn about the topics on which the project

focuses, as well as the tools used in carrying out projects

- an opportunity for students to gain more IT knowledge and skills and for them to learn to make practical use of their IT knowledge and skills
- an opportunity for students to learn to work with minimal external guidance, both individually and in groups

This workshop is based on a philosophy of constructivist education. Constructivism assumes that a learner constructs new knowledge, building on whatever base of knowledge the learner already has. Learning is an individual and personal thing. No two students bring the exact same previous knowledge and experience to a new learning situation. As every teacher knows, the range of differences among the students in a typical class is truly astonishing!

Some important educational ideas emphasized in this workshop include:

- both teachers and students explicitly focusing on transfer of learning
- discovery-based learning; learning by doing; active learning; being engaged
- metacognition (thinking about one's thinking); reflection about what one is studying and learning
- peer teaching and peer evaluation
- authentic assessment
- self-assessment
- teachable moment
- problem solving and improving higher order cognitive skills

A unifying goal in the workshop is sharing among participants and learning from each other.

Poster Session

Keeping PACE with the Future: Parents and Children in Education

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Key Words: education, multimedia, parent-training, eMate, HyperStudio, family

The goal of the PACE program is to integrate parents into the technology-driven curriculum in our school. Teachers use parents as role models, facilitators, and mentors to help their children learn and use technology. Parental support and involvement in education strengthens the bond between teachers, parents, and students when children can see the benefit of working together—realizing that we care. Organized, parent technology volunteers spend time each week in classrooms working with children. Not only does it give the parent an idea of what is going on at school but it also allows them to become an active participant in their child's learning.

One example of the PACE program is a six-week technology session offered for parents and their children on various aspects of technology used in the classroom. The classes are designed to reflect the types of projects created in our school. Parents and students work as a team to develop a HyperStudio project, about their family, which is converted to video for them to keep. Participants have opportunities to gain experience using multimedia software, scanners, digital cameras, laser discs, and the Internet. This gives parents the training needed to become technology volunteers in the classroom and learning partners at home. This project provides students real-life application of technology and links learning at school to learning at home.

The PACE program also includes parent-student training sessions for use of eMates before home check out. These classes are taught in four hands-on sessions after school giving an introduction to eMate and Newton Works. Classes demonstrate how eMates are used and integrated into the classroom curriculum. Training will ensure parents have the understanding and ability to assist their children in the use of eMate to complete school assignments and projects. eMates, available in our school, provide an ideal and equitable solution for involving parents and students in technology-based education, in and out of school.

Offering after-school, or evening, training sessions for parents and students gives the school a unique opportunity to reach out to the community. These classes are provided free, or at a minimal cost, to ensure educational equity for all. The PACE program provides parents with basic computer training, using a variety of software programs and peripherals, while establishing a commonality in learning for the parent and child.

This poster session is designed to provide attendees with ideas, guidelines, and the motivation to involve and educate parents about the use of technology in today's learning environment. While this program is used in an elementary school, it could be easily adapted into middle and high schools.

General Session: Exhibitor Session/Emerging Technologies

GlobalTrek: On the Road ... to Discovery!

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Key Words: curriculum, Internet, World Wide Web, standards, GlobalTrek, AmeriTrek, learning, adventure

Author

The Internet is constantly evolving—it's a young medium. K–12 resources on the Internet are even less mature. Initially, such sites were no more than organized collections of links. These were helpful but sparse on content. Next, came a new and innovative approach: unique content from around the world. The initial examples of this approach, though, focused on fairly esoteric curriculum areas: Egyptology or archaeology, for example. Plus, these resources lasted only a few weeks and would be over.

Now, the next innovation in educational Internet sites has arrived. These sites focus their energies on mainstream curriculum topics, those that are already being taught in our classrooms. In addition, they augment those areas with live and nearly live experiences that students could not otherwise receive from their desks. Finally, these resources are longer-term, lasting a half-year or even a full school year.

Leading the way, GlobalTrek, Inc., is excited to present *AmeriTrek*. Your students will participate with a team of educators in a trek around the United States. Join us as we visit historic monuments, watch government in action, and talk to the fascinating people that make up this country!

AmeriTrek includes a direct link to our team of educators through our Web site, a classroom kit, and the opportunity to participate and shape the trek through communication with our team and other participating schools.

All you need is Internet access and a free Web browser (e.g., Netscape, Internet Explorer)! Starting August 28, a team of educators will embark on a journey around the United States. With *AmeriTrek* your students can be there every step of the way! Once the trek begins you will receive a password giving your entire school unlimited access to the activities and adventures for the entire 40-week trek period. You can check out the advance Web site now at http://www.globaltrek.org/.

It's a great way to use Internet in your classroom. Students will be able to find out what's happening each week through video, text, and sound. They'll be able to chat with others and ask questions of the traveling team. They'll even be able to provide input about some route variations and places to visit! *AmeriTrek* is a structured way to use the Internet, and it is tailored to national curriculum standards and benchmarks—so you can easily integrate it into your classroom activities. There are a wealth of learning opportunities as categories covered weekly will include: geography, social studies, science, health, arts and literature É and much more!

To accomplish this, GlobalTrek has assembled a classroom kit for all subscribers. This includes a 40-week teacher's guide and lesson plans; weekly online programming and activities for fourth- to eighth-grade students beginning August 28, 1998; unlimited access to the *AmeriTrek* Web site; and a packet of "goodies" for your students (such as wall posters, stickers, etc.).

GlobalTrek, Inc., is a private, nonprofit 501(c)(3) organization. Thanks to the generous support of donors and sponsors, the 40-week subscription rate will probably cost your school less than $1 per student!

This is a great opportunity to make the Internet a powerful tool in your classroom. *AmeriTrek* furnishes everything you need to provide a meaningful and exciting educational experience for your students.

Spotlight Session

How Do I Know That Professional Development Activities Are Reaching the Child's Desk?

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Key Words: professional development

Although great sums have been spent on professional development activities, there has not been a significant increase in student achievement as a result of these activities. Many teachers have not implemented these new strategies in their daily teaching. These teachers follow the old "sit, get, and forget" principle when participating in professional development.

To overcome this problem, the New Orleans Public Schools Urban Systemic Initiative developed and implemented a new model of professional development. This model includes rethinking how stipends are paid, how individual schools develop their own professional development plans, how funds are aligned to support professional development, and how quality professional development can reach the 5,000 teachers in the district. We have examined the role of the principal as well as the role of the district in supporting professional development.

General Session: Curriculum Design/Strategies

Technology: An Essential Tool in Teaching and Learning Mathematics

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Key Words: mathematics, problem solving, connections, reasoning, communication, computer applications

The NCTM Standards have been available since 1989. The vision is the vision for the 21st century. Educational goals for students include the importance of students becoming problem solvers, students being able to communicate and reason mathematically, and students being able to make mathematical connections. An essential tool in preparing students for this vision of 21st century mathematics is technology. How we teach and learn mathematics must change to match the way mathematics is developed and learned in the 21st century.

This session will focus on learning and teaching mathematics using technology as an essential tool, Grades 5–12. Consider the use of spreadsheets to explore mathematical patterns and concepts. Explore geometric concepts using Geometer's Sketchpad; develop and test conjectures about relationships through graphical analysis and interpretation; investigate problem using and emphasize the importance of estimation through the use of technologies using ClarisWorks. Use Math Connections software to encourage students to develop and test conjectures about the connection between algebraic and graphical representations of lines and curves. Instructional strategies with these ideas (and many more) will be described to assist educators in embracing the vision of the 21st century in which technology is an essential tool in the teaching and learning of mathematics.

General Session: Curriculum Design/Strategies

Effects of El Niño: Analyzing and Interpreting the Climate Data

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Key Words: mathematics, problem solving, connections, reasoning, communication, computer applications

What climatic changes are seen as a result of El Niño? Was the winter of '98 unusual or was it within the typical climatic variation for specific locations? Use mathematical reasoning and problem solving to explore problems using climate data found on the Internet. Explore actual climate data to involve students in problem solving and inquiry activities dealing with climate data to investigate the question of whether El Niño affected the weather during the winter of '98. With the data available through the Internet, teachers and students are able to access the information easily and then explore the data using spreadsheets with graphing capabilities as a means for analyzing and interpreting the data. Time-series analyses are developed to provide a clearer vision of the trends in climate. Comparison of these patterns with weather data from the winter of '98 allows students to consider the effects of El Niño. A problem-solving format is used to investigate the climate questions and provides the participants with ideas for incorporating with teaching and learning mathematics (Grades 7–12) in which students are encouraged to design PowerPoint presentations using their interpretations of the evidence.

General Session: Curriculum Design/Strategies

What Is and What If: Technology Tools for School Reform

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Key Words: school reform, assessment, budget, schedule

Schools involved in reform quickly realize that changes that initially look simple quickly become complex. An innovation introduced in one part of the school will affect many other parts of the school. In this workshop, we will look at a couple of key areas of reform—the use of portfolios for assessment and the allocation of time and money (in creating a schedule and budget). We will look at technology tools that help consider "what is" happening in the school and "what if" other changes were made.

Portfolios

Changes in the assessment system—specifically, the use of portfolios and alternative assessments—can necessitate changes in the way the school operates and communicates. The Digital Portfolio is a multimedia software tool that allows schools to articulate a vision of what students should know and be able to do, and allows students to present work that shows how they are meeting that vision. During a three-year study with six member schools of the Coalition of Essential Schools, we found that Digital Portfolio, if it is going to be more than a technological gimmick, requires changes in a school's assessment practices, its culture of relationships among teachers and between teachers and students, its use of time and space, and, of course, its approach to technology.

The Digital Portfolio shows "what is"—that is, a sense of a student's abilities. Now, what if schools wanted to use portfolios to communicate with colleges, employers, and state departments? We will discuss a project called Dynamic Benchmarking that could allow schools to engage in dialogues with these outside stakeholders. This could be a process that shows how students are meeting standards set by those stakeholders through an online conversation about student work.

Schedules and Budgets

Another critical area of reform is the re-allocation of resources to support school change. A new tool can allow a school to enter current information about its resources: expected numbers of students and faculty, existing schedules and budgets, and so on. The users of the environment can then make changes to one part of the system—say, moving to block scheduling—and see how other parts, such as the budgets and staffing plans, might be affected. This environment will also allow schools to gain an understanding of what various changes are supposed to accomplish, and to examine the trade-offs between existing strategies in the school and the changes that are proposed.

Through these tools, we hope school communities can gain an understanding of the process of school change—specifically, how changing one part of the system affects all of the parts—and how technology can help with documenting change and considering new possibilities.

General Session: Technology Training/Staff Development

The Technology Infusion Project (TIP): An Inservice/Preservice Collaboration

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Key Words: technology, preservice, inservice, training model, collaboration

Introduction

In 1997, the President's Panel on Educational Technology recommended more attention be focused on professional development opportunities. The members of the panel concluded that the substantial investment in hardware, infrastructure, software, and content would "largely be wasted if K–12 teachers are not provided with the preparation and support they will need to effectively integrate technologies into their teaching." In addition, a report by the Office of Technology Assessment (OTA) noted that:

> *Despite the importance of technology in teacher education, it is not central to the teacher preparation experience in most colleges of education around the United States today. Most new teachers graduate from teacher preparation institutions with limited knowledge of the ways technology can be used in their professional practice. (OTA, 1995)*

Clearly, we must prepare educators to effectively integrate educational technologies into their teaching at both inservice and preservice teacher preparation levels.

A Field-Based Technology Infusion Project

The technology infusion project (TIP) is a model that builds a bridge between preservice and inservice teachers. The program is jointly supported by the Curry School of Education at the University of Virginia and Albemarle County Public Schools. The goals of the program include the following:

- to develop relationships with teachers in public schools to collaboratively explore instructional applications of educational technologies
- to provide preservice teachers in-depth experience with the use of educational technologies in classroom settings

As part of TIP, preservice teacher education students enroll in an Introduction to Classroom Computing course. This course addresses the use and integration of educational technologies, such as hypermedia, multimedia, telecommunications, windowing systems, digitized video and audio, and desktop publishing in K–12 classrooms.

In many cases, the traditional computing course for preservice teachers often results in a stand-alone, skills-based course. Preservice teachers have noted that while these courses teach them *about* various kinds of technologies, they often lack the experience needed to teach *with* technology. The strong field-based component of the TIP model addresses this concern. As part of the program, university students are paired with participating classroom teachers to collaboratively explore educational technology applications in actual classroom settings. This experience allows students to experiment and understand both the opportunities and barriers to use of classroom technologies.

Preservice teachers complete profile sheets during the first class meeting describing their goals and experiences with technology as well as noting preferred grade levels and subject areas. Because personal motivation is an important factor in developing computer-using teachers, inservice teachers must fill out an application that identifies those willing to commit to the program in terms of time and resources. Based on the information gathered from preservice and practicing teachers, the TIP director works with the manager of Information Services at Albemarle County to create pairs based on similar interests.

After placements have been made, participants in TIP attend an orientation meeting. At this meeting, university students are introduced to the inservice teachers with whom they will be working. The meeting provides an overview of what to expect with regard to the field-based component of this course, outlines goals and responsibilities for all participants, and gives the pairs an opportunity to discuss possible projects and schedule future meetings and classroom visits.

During the first half of the semester, university students meet every Tuesday and Thursday at the School of Education's instructional lab and concentrate on mastering a range of educational computing competencies. By coordinating placements at an early stage of the program, students have opportunities to collaboratively plan small miniprojects with teachers. Teacher education students are expected to go into a classroom for a minimum of an hour each week to share what they are learning, explore and discuss possible instructional applications, work with the teacher and class on small miniprojects, and plan activities for an in-depth instructional project.

The second part of the semester is devoted to implementation of newly acquired skills. Students are expected to work in the classroom for 2.5 to 3 hours each week, and attendance of Thursday sessions at the university is optional to make up for the extended time in the field. Students focus on implementing an instructional project with the assistance of the classroom teacher. The instructional project provides students with the opportunity to explore an instructional idea in greater depth than is possible through weekly competencies. It is designed to engage them in exploring how various technologies can be integrated into the curriculum in ways that enrich and extend learning. One outcome of this project is the development and documentation of a unit or series of miniprojects that can be shared with other teachers. More importantly, TIP participants develop a sense of how to manage and use technological resources in schools.

This preservice/inservice program produces synergies that benefit both parties. Participants in the program have opportunities to explore the role of computers in education. In addition to learning to use various types of instructional software, participants select, evaluate, modify, and integrate educational technology applications into specific content areas. Educators serve as "teachers as researchers" in identifying ways in which technologies may be best put to instructional use in K–12 classrooms.

Summary

A collaborative relationship is essential and, from the outset, university students are not introduced as computer experts but rather as learning partners. It is essential that inservice teachers take on an active role in this process. Once the semester ends, preservice teachers will no longer serve in the same capacity, and we hope that inservice teachers will continue to explore instructional applications of technology with their students.

> *While technology is not a panacea for all educational ills, today's technologies are essential tools of the teaching trade. To use these tools well, teachers need visions of the technologies' potential, opportunities to apply them, training and just-in-time support, and time to experiment. Only then can teachers be informed and fearless in their use of new technologies. (OTA, 1995)*

The combined efforts of a university and surrounding school district can provide some solutions to these issues. It is important to understand that this is not the only answer to providing adequate training for teachers. In many cases, the TIP experience has served as a catalyst, motivating teachers to pursue additional opportunities. The creation of a cadre of technology using teachers is an ongoing process that takes time. The program, however, can serve as a model for developing partnerships to prepare both preservice and inservice teachers to use technology in a time when technological competence is no longer seen as an option but as a requirement.

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National Educational Computing Conference 1998, San Diego, CA

General Session: Curriculum Design/Strategies

CLASS - Using Innovative Technology for Extended Education

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Key Words: distance education, extended education, distance learning, technology, Web-based courses, instructional design

Description

With $18 million in federal funding, the Communications, Learning, and Assessment in a Student-Centered System (CLASS) Project is creating an accredited high school diploma sequence for delivery on the World Wide Web. Using innovative technology, the CLASS Project maximizes student learning through the use of moving imagery, graphics, sound, and text within a seamless navigational system that encourages individualized discovery and learning.

The Project

The CLASS Project's goal is to make available on the World Wide Web a complete, accredited, high school diploma sequence. The Department of Distance Education of the University of Nebraska-Lincoln is the recipient of $18 million in federal funding to develop the sequence. When completed in 2001, 54 CLASS courses will be available for students to complete these requirements.

The Department of Distance Education is uniquely suited to provide this diploma sequence. Among its units is the Independent Study High School (ISHS). The ISHS is the only university-based, fully accredited, independent-study high school in the

United States. In operation since 1929, and accredited by both the North Central Association of Colleges and Schools and the Nebraska Department of Education, the ISHS currently serves about 15,000 students annually in 136 countries. The students can choose among 138 print-based courses. Enrollment is open, with students registered throughout the year.

The Courses

The development of courses for this project requires the recognition of several factors. Paramount among these is the World Wide Web offers a new and different method of delivery. Therefore, the ISHS print-based courses cannot be simply transferred to the Web. Second, to fully use the potential of the Web as an educational delivery system, new software and technologies need development. Third, production of these courses will take place in a manner different than traditional multimedia production. To put it simply, the project requires invention in both the areas of technology and instructional design.

CLASS is a dynamically interactive, student-centered course environment. Students acquire content through moving imagery, graphics, sounds, and text bundled in a seamless navigational system that encourages individualized exploration. “Seamless” means that students do not have to open and close applications to move from a text screen to simulation, video, or discussion group. The technology needed to support all of a course’s media is provided within the electronic learning environment. CLASS course instructional design includes interaction between learners and instructors, stressing the development of life and workplace skills, citizenship responsibilities, and critical thinking. New technologies provide learners with access to digital libraries from national, historic, scientific, and research centers over the national and global information infrastructure.

CLASS helps students manage their learning by providing an electronic “notebook” where students can store and sort everything from video to text. Students can share their notebook pages with other students or the teacher.

Instructional Design Features

Founded in constructivist learning theory, the CLASS courses use interactive designs and student-centered activities to facilitate learning. The seamless design enables ongoing self-checks, evaluations, and assessments, which empower students to interact with the courses in sequences or patterns that match their learning styles.

In addition to the Web-based instruction, learning in each CLASS course is supplemented by an ISHS or site-based teacher. Embedded within each course toolbar is an e-mail link to the teacher who quickly answers questions. Each course also includes a newsgroup where the teacher may post general announcements or moderate discussion about course-related topics.

Student-to-student collaboration is also featured in CLASS courses. Writing students develop their peer critiquing techniques. Other students build multimedia projects together right on the Web.

CLASS courses are reaching to use the Web to its fullest instructional advantage. Content is written specifically for the Web, scaffolded for broader and deeper experiences with the subject matter, and designed so students have choices of direction and activity. Integral to the CLASS learning environment is wide use of audio and video. Original audio and video files, such as student testimonials about learning strategies in the Learning FUNdaMENTALs course and refugees discussing their experiences during the Bosnian conflict in the Bosnia: Global Perspectives course, produce an inclusive learning environment. Animated tutorials and interactive self-checks provide modal learning experiences. In Geometry in Our World, students interact with a tutorial on how to measure the area of a circle. In Bosnia: Global Perspectives, students study geography using drag-and-drop maps. In fact, each CLASS course illustrates yet another learning method enabled by the dynamic, multimedia capabilities of the Web. And each course is full of World Wide Web links to enhance and reinforce learning.

CLASS provides new avenues of educational access through cost-effective alternatives to conventional classroom teaching situations. These new avenues are particularly important when reaching out to all levels of students, including nontraditional students, geographically isolated or disadvantaged segments of the population, at-risk individuals, and the gifted. Because of its size and scope, the CLASS Project has the potential to revolutionize the distance delivery of courses to individual students, learning centers, and schools that cannot afford or do not have the ability to offer such opportunities.

Currently four courses are available for enrollments, and an additional six courses are in beta testing. Examples of the initial four courses, along with additional information on CLASS can be found at http://class.unl.edu.

Paper Session

Northeast Louisiana University Teacher Enhancement Program

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Key Words: Internet, technology, trainer, computer, math, science

Abstract

Technology is now being addressed nationally as an integral part of both the Standards of Science and the Standards of Mathematics. With this drive has developed an urgent need to train our educators not only to integrate technology into to the curriculum but also how to use technology itself. The desire has been the driving force behind, what has become known as, the Northeast Louisiana University (NLU) Teacher Enhancement Program. It is the goal of this program to prepare teachers to use the Internet with sufficient skill to effectively integrate resources of the Internet with state mandated curriculum guides, translate the technology into daily activities in mathematics and science courses, and train their colleagues. Is this program successful in achieving this goal? To evaluate this, the participants were given a survey that included both objective and open-ended questions. The following document is a summary of their responses. Because Group III has just begun the program, they provided limited responses to the open-ended questions. Group II has yet to put the program to practice, but many have examined how they will incorporate technology into their curricula during the new academic

year. As a whole, an overwhelmingly positive attitude toward the program was expressed by most of the respondents.

Once training has been received, it is only natural that previous classroom climate will be changed. But in what ways? Participants were asked what major changes have been made in the way that they conducted classes before using computer activities? The primary response from Group I was the use of the Internet as a teaching tool and incorporating technology into their group projects and team work. Likewise Group II, which has received only training and is returning to the classroom this year for practice, has made plans to use the Internet to expose the students to facets of learning to which they otherwise would not have access. For example, one teacher plans to have students visit a site addressing fractals. Until this time, she has only been able to offer students black and white pictures. Another teacher anticipates her new role as "an information guide, rather than an information provider." Taking this view, students will be able to construct their own knowledge and, as another Group II participant noted, students will experience "more discovery learning."

Introduction

The following statement appeared in a 1992 survey report, "Education and the New Information Technologies—Teacher Training," released by the Centre for Educational Research and Innovation of the Organization for Economic Cooperation and Development (OECD):

> *The potential of the new information and communication technologies for improving learning and teaching will not be realized unless teachers are well trained and retrained in their pedagogical use. Familiarization with the technologies is not sufficient; the real challenge is the training of teachers in the use of interactive technologies for nontrivial applications, such as simulations and model building, problem solving, complex microworlds, or exploration and discovery, and even judicious uses of basic software packages, such as word processing, spreadsheets, and databases.*

The essence of the Teacher Enhancement Program at Northeast Louisiana University (NLU) was a plan to address one of the problems implied in the above statement; namely, the training and retraining of classroom teachers (trainers) who would train and retrain their colleagues and students to use the Internet to expand and enrich their educational experiences. Our project was made feasible because the State of Louisiana established a statewide network, LANET, in December 1992. By December 1993, provisions were made for all public and private colleges and universities in Louisiana to be connected to LANET and, consequently, to the Internet. The state instituted a master plan calling for all K–12 schools to gain access to LANET starting in 1994. The missing link was a comprehensive training program for educators that would stimulate the application of Internet resources in the classroom and the continued growth of teachers.

Northeast Louisiana University and 15 local school districts joined in addressing this need through this project, which was funded by the National Science Foundation Teacher Enhancement Program in 1995. When it is completed in 1998, this three-year project will have provided these school districts with a cadre of well-trained resource persons and the support necessary to benefit from electronic networking. This project will, in the space of three years, have prepared 60 teachers to use the Internet with sufficient skill to effectively integrate resources on the Internet with state-mandated curriculum guides, translate the technology into daily activities in mathematics and science courses, and train their colleagues. Personal networking and electronic communication channels will have been established so that these teachers will have access to sources of expert assistance in their teaching endeavors at all times.

The teachers chosen to participate in the project had to have demonstrated the ability and desire to enhance the way that science and mathematics were taught in their schools. These distinguished teachers had to assume graduate assistant positions for two semesters and one summer at NLU while on sabbatical leave from their respective schools. Coursework taken during their assistantships included not only specific Internet training and incorporation of Internet mathematics and science applications into the classroom but also education in methodology and leadership training. The goal of the project was that the teachers not only learn how to navigate the network but that they also have the skills necessary to return to their school districts as resource persons capable of training others to use the Internet.

Why Do the Survey?

Because we were midway through the project we wanted to evaluate the results at that point. The survey looked mainly at what impact, if any, technology was having on the participant and his or her students as a direct result of being a part of the NLU Teacher Enhancement Program. Open-ended questions were designed to investigate changes, if any, in teaching methodology and to what extent these changes were impacted by the implementation of state and national standards for mathematics, science, and technology. Also targeted were changes in teaching style as a direct result of using computer activities and how these changes have affected classroom procedures. The results of the survey are also being used to help determine the direction that the NLU Teacher Enhancement Program should take before resubmitting for a future program of this type. The survey collected information about the participants, such as teaching background, demographic information about school and school district, and professional enrichment and training activities. We feel that these issues have a direct impact on the participants and cannot be ignored when viewing the results from this survey.

Who Responded to the Survey?

A total of 27 participants responded to the survey. The chart below categorizes the groups from which the survey responses came.

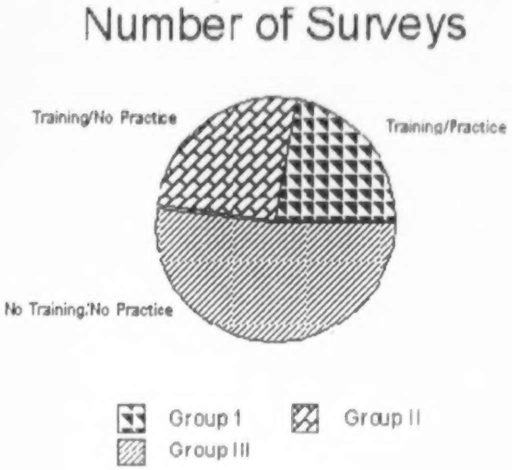

Figure 1

Replies from the survey reflect a sample from each group, with more than half of the responses from Group III because they were in class when the survey was taken. Although the numbers were small for Group I and II, they reflect 33.3% and 36.8% returns, respectively; Group III had a 66.7% return of surveys from participants. Participants from all three groups represent a sample from each grade level that is demonstrated in Figure 2.

The three groups were categorized by the level of their participation in the program. Group I, 1995–96, as having (training/ practice), Group II, 1996–97, as having (training/no practice) and Group III, 1997–98, as having (no training/no practice). Group I had finished an intense program during the 1995–96 school year taking graduate-level courses that included a practicum. This practicum was conducted in their parish as a computer technology liaison and trainer.

The first section of the survey asked the teachers questions about their teaching experience. Information on how many years of teaching experience, grade level of experience, and subject matter that each had taught is summarized in Figure 2 and Chart 1.

In analyzing Question 1, Group II and Group I teachers reflected averages of 18.7 and 20 years of classroom experience respectively. These numbers alone would lead one to think that both groups had equally experienced teachers. However, the minimum and maximum numbers for Group I were 14 years to 24 years, while Group II had 9 years to 24 years. Group III displayed the least teaching experience with an average of 13 years of teaching experience with a minimum of 7 years and a maximum of 18 years. This observation was interesting because it was the seasoned teacher who became involved with a program that emphasized technology rather than the teacher with less classroom experience.

Responses to Question 2 are summarized in Figure 2, which shows the grade level for teaching experience of the participants. The results show that the background of Group I participants represented school types of K–12, elementary, and middle schools; Group II represented a sample from each of the school types; while Group III dominated elementary, middle school, and high school levels. This indicates that on completion of the three-year program, there will be a base of experience and expertise available for each grade level of K–12 on the use of the Internet for the participating districts.

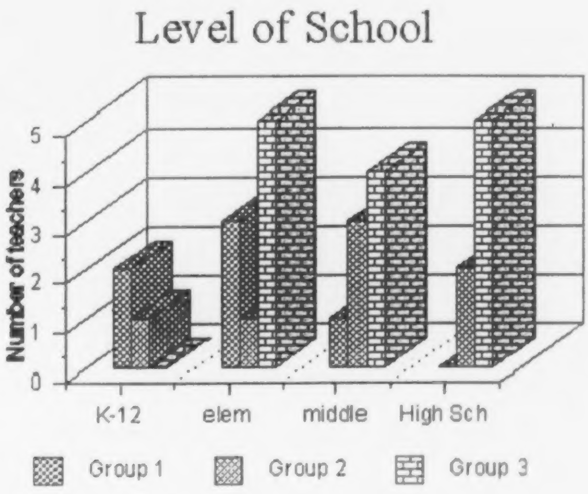

Figure 2

Subjects Taught

Chart 1. Subjects that have been taught by the participants.

4% (1)	Astronomy	18.5% (5)	Technology
4% (1)	Biology	48% (13)	Elementary School Science
4% (1)	Chemistry	44% (12)	Elementary School Math
18.5% (5)	Computer Science	33% (9)	General Mathematics
25.9% (7)	Earth Science	14.8% (4)	Algebra
14.8% (4)	Environmental Science	14.8% (4)	Geometry
22% (6)	Life Science	7% (2)	Pre-calculus
22% (6)	Physical Science	7% (2)	Calculus
18.5% (5)	Social Science	4% (1)	Probability/Statistics

The results show that elementary math and science along with general mathematics brought the highest numbers of the participants. There were very few participants that taught high-level courses, i.e., calculus, statistics, and chemistry. Group III's survey replies were double the number of Group I or Group II, which reflected the fact that they were currently enrolled at NLU.

Question 4 shows that this program should have significant impact at the elementary level with slightly less than half of the responses indicating that they have been teaching elementary mathematics and science.

The results from questions 4 and 5 reflect that the participants represented every grade level of school and a wide area of subject matter that is being affected by the participation of the teacher. As stated in the introduction, the thrust of this project was to train K–12 teachers in the use of the Internet with emphasis on integrating its resources in teaching mathematics and science.

State and national standards for mathematics, science, and technology stress that instructional materials and equipment can increase students' interest and improve achievement. Students should have access to materials and equipment and be offered opportunities to learn to use them effectively. It is essential that classroom teachers have the necessary nonconsumable and consumable material and equipment and that they have means to maintain and/or replenish these as needed. With this in mind the survey directed questions 5–19 to investigate the school and school district profile of each participant.

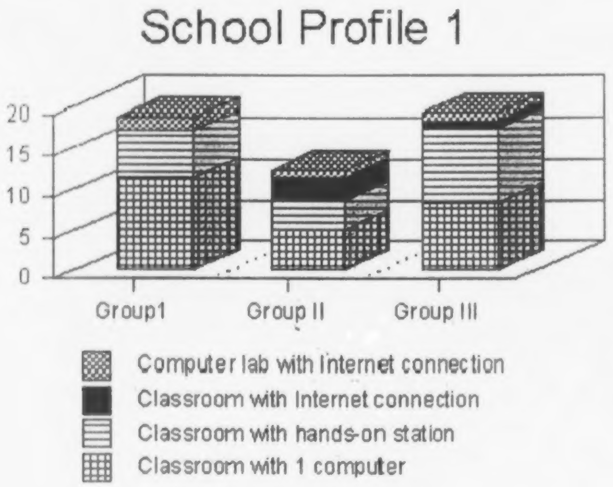

Figure 3

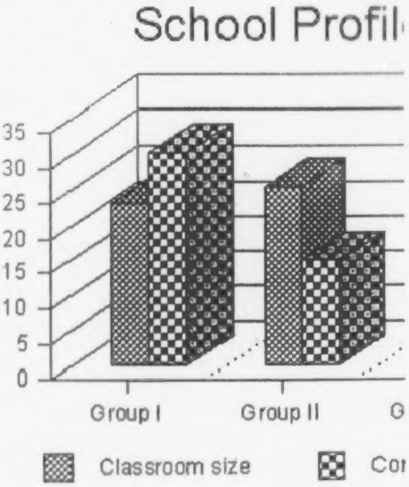

Figure 4

Figures 3 and 4 demonstrate that there is a critical need for more classrooms that are equipped with computers and Internet connections. For reform to occur in mathematics, science, and technology, it is imperative that hands-on teaching is included in the curriculum. It is recommended by the National Council of Teachers of Mathematics and Science that classrooms should keep current with the state-of-the-art technology appropriate for the grade level being taught.

The results of our survey show that schools and school districts have projected an increase in their spending for technology for the 1997–98 school year. We are sure that this is a direct impact of the new technology plan that was implemented this year at the state level. Millions of dollars were earmarked to enhance technology at the K–12 grade level by the state legislators.

In personal interviews with several of the participants of this program, many have played key roles in authoring and researching information for their parish technology plans that were submitted this past July to compete for these funds. Several participants from Group I and Group II have also taken on new jobs as technology coordinators for their districts.

Professional enrichment and training are illustrated in charts 2 and 3. The thrust of the program was to prepare the participants to return to their schools and districts as trainers. This program provided opportunity and encouragement for the participants to attend state and national meetings in their disciplines and to become involved with the technology plans in their own districts. It opened the door of opportunity to many as they have returned to their districts as the technology coordinator and Internet trainer. For some these skills have taken them beyond the schools and into the community through training for local businesses, organizations, and churches.

Professional Enrichment

Chart 2. Workshops that participants attended.

44% (12)	attended hands-on workshops for technology training
44% (12)	attended hands-on workshops for Internet training
26% (7)	attended hands-on workshops for incorporating technology with the curriculum

Professional Training

Chart 3. Workshops that participants conducted.

3.7% (1)	have instructed hands-on workshops on technology training
48% (13)	have instructed hands-on workshops for Internet training
7.7	have instructed hands-on workshops for incorporating technology with the curriculum

State and national standards require the integration of technology into the curriculum. To what extent have state and national standards for mathematics, science, and technology affected the participants' teaching of the curriculum? Having been exposed to these standards, many of the Group I teachers stated that changes have been made in the classroom to reflect those standards. Following the lead of the national standards, new benchmarks have been mandated by the state. At least one of the local parishes has also developed a technology plan and is presenting it to the state for approval. Another teacher commented, "My curriculum was affected drastically in that I teach math only. The standards are very well planned, and it is easy to find Internet access to sites that are in conjunction [with the standards]." Group II teachers anticipated that they will be using more discovery techniques with more observation-type [as opposed to test] evaluation. Instruction will be geared more to application orientation rather than rote memorization.

Changes have been made in the teaching styles of most participants as a result of using computer activities. Many of the Group I teachers had been using computer-assisted instruction before joining this program; they therefore have expanded this usage even more. Technology allows students the opportunity to model activities for other classmates. One teacher noted that she is now more flexible. She has rewritten existing lesson plans to incorporate the computer, and this has improved classroom instruction. She has also learned to be more patient, step back, and let the students use the technology. Likewise in Group II, these educators planned to assume the role of the facilitator, thus allowing their students to have more responsibility in their learning. One educator noted that she feels that she is now able to accommodate more learning styles.

Different expectations of students have developed as a result of using the computer for class activities. Teachers in Group I have found that their expectations for their students are greater. They required students to use the computer to complete in-class assignments because, with the incorporation of technology in the classroom, students now have access to material and information that without the technology they would not have available to them. Those from Group II planned to use Rubric for grading. The concentration will not be so much on the correctness of the answers but on how the students arrived at the results. As one respondent noted, this will allow for more individualized instruction.

Another result of these changes is the use of different materials and examples. The computer and, more importantly, the Internet are being used more in the classrooms of the program's participants. To make this successful, teachers of both Group I and Group II are finding resources for lesson plans on the Internet. Many different materials are being used to reach every learning style. Hands-on equipment is used to complete activities that were, in the recent past, normally completed with paper and pencil. Group II members predict that they will be experimenting with more types of software and attempting to make computer activities a normal part of the day rather than a separate entity.

Are teachers evaluating their students differently as a result of using this new technology? The answer is yes. Alternative methods of assessment are being discovered by Group I and Group II. One respondent of Group I noted that no one test is a good tool to measure a student's ability. In Group II, Rubric will be used by several of the teachers. A Group II educator pointed out that computers bring out the best in some students, and consequently she expects a positive difference to be reflected in their performance. On the other hand, one teacher in Group II noted that she will be using computer tests and computer graded tests (bubble tests). While this is not an innovative use of the technology, it is a practical one.

What part of teaching with computers is viewed by the teachers as the most difficult? A great deal of planning and organizing has to be done to use computers in the classroom. This was the consensus of both groups. Accommodating students who do not have many computer skills and are not secure in the new environment was a major concern of one of the Group I members. In other words, each student must be brought to a common point of understanding. Most are either very knowledgeable or have no experience at all. Another issue of difficulty that the participants have addressed is the shortage of computers for effective instruction and the money needed to upgrade and connect to the Internet. Members of Group II foresaw many of the same difficulties. They also noted the need to plan for failed access to the Internet. In other words, what back-up activities might be needed, or what can be done while waiting for the downloading of links during heavy use times.

The teachers were asked: What do you most enjoy about teaching using computer activities? “Everything! It is magic in the classroom. The kids love it!” responded a Group I educator. Others noted that it is motivating for the students and, as a result, the instructor. It offers versatility and piques students’ interests. Group II foresaw that having up-to-the-minute information available would be an asset.

Participation in the program was viewed as beneficial to the participants’ professional development. The teachers of both groups have acquired expertise in this area, and these participants are now able to train others, and they themselves have grown professionally; thus they have received “beneficial exposure.” Additionally, through this program some Group I and Group II teachers have been able to attend NECC and LACUE conferences and work toward master’s degrees and plus 30, in addition to attaining certification in computer science. Another Group I teacher noted that this program has delivered a new excitement about teaching. It was explained by a Group I participant that these teachers have been provided with an opportunity and the time to explore a medium that, at the beginning of the program, they knew nothing about. Group II members noted that at this point they have become more aware of changes in technology and how to integrate it into instruction. They were excited that, through the workshops they have taught, they were able to transfer their new found knowledge and excitement to other teachers in their parishes.

The participants were asked: Overall how was your participation in the program beneficial to your students? “Whenever a teacher is excited about something new, the children know it, and when that knowledge is shared, they grow! My students have blossomed! They enjoy the computer, the Internet, and they enjoy being successful! If children do not learn the way we teach them, we must change and teach them the way they learn. Computers enable us to do that, and so does this program!” replied a Group I teacher. Furthermore, students are learning skills that will help them get a job, responded another Group I participant. A Group II member observed that when students are “playing” on the computer more retention has been observed and interest has increased.

Participation in the program is viewed as beneficial to the teachers’ schools. A

Group I educator noted: “I gained training expertise. I am able to go out and train others, and I am able to use the knowledge I have gained to grow professionally, and also secure grants for the school.” Teachers are now trained and can provide staff development training in basic computer terminology and the Internet. A Group I teacher’s home school was even selected as a pilot school for their Parish technology project in the spring of 1997. Many of the participants have been able to have their schools connected to the Internet. Group II participants have also had similar experiences. Teachers have aided their schools in writing technology plans. One participant is expecting improved standardized testing results, as well as decreased discipline problems.

When examining the programs benefits to the school districts, it was found that these educators have been able to extensively train other teachers in the school systems with Internet. Others felt it has helped move their schools forward. It was also noted that among teachers, a positive attitude is growing toward technology. One respondent stated “Hopefully my participation and the other teachers’ participation will inspire funding and commitment to technology.” Group II respondents also had very positive statements. One teacher announced, “I have had great support. My district is willing to try all forms of technology. We are striving to put a computer in every classroom. We did a tremendous amount of training all summer.” These teachers will now be able to help the district meet its goal of producing productive citizens. Participants have helped to write the parish technology plans, which will aid in receiving technology funding from the state. Participating parishes will become more competitive in the “technology race” and will better prepare students for future career success.

Reviewing the responses of the participants of Group I, it is apparent that the program is achieving its goal. Attitudes toward the program are very positive, and the results are beneficial on not only the personal but the school and district levels as well. The visions that Group II expressed reveal their enthusiasm toward technology in the classroom. It is this enthusiasm that radiates and thus creates desires within others to pursue the benefits of technology. Based on the plethora of benefits cited by the participants of Groups I and II, it can be assumed that Group III will follow the same path.

With the incorporation of technology mandates into national standards of both math and science, it seems only logical that the other disciplines will soon follow. Assuming this, the far-reaching benefits of this program seem even more vast. Areas such as language arts and social sciences typically have not viewed technology as an integral part of their curriculum. However, major components of their curriculum, research, and writing, naturally lend themselves to current technology. The participants in this program have developed, as their responses have shown, an ability to attain an understanding of the technology, integrate technology into their curriculum, and train others in math and science to do the same. These trainers are the likely candidates to continue the training of teachers in these other disciplines.

Paper Session

Effective Means to Help Teachers Master Computer Applications

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Key Words: application, novice, experience, declarative, conceptual, procedural

Abstract

The computer has become an indispensable tool for teachers. Presently, many teachers are making efforts to master needed computer application skills. The current study first focused on the differences between novice and experienced users to identify possible task-oriented factors that might help novice users overcome the learning curve. Errors frequently committed by novice and experienced users were compared. The current study also examined the implementation results of several instructional devices throughout a microcomputer application course to determine the effects based on students' performance. Students were also surveyed for their opinions about which means they believed to be beneficial to their learning.

Overview

Computer skills and knowledge are crucial for teachers to become productive and efficient. Currently, computer application courses have become widely available in various teacher preparation programs. However, many factors—unequal access to the hardware and software; diverse interests, background, and skill levels; insufficient effective learning resources; and platform differences—have discounted the computer instructor's effort and distracted the focus of proper instructional design and implementation.

There have been many studies concerning how computers interact with users during the learning of application tasks. Larner and Timberlake (1995) suggest that the major obstacle to instructional technology is negative attitudes toward technology, and the lack of expertise or experience is the major reason for such negative attitudes. Studies also support the notion that appropriate preservice and inservice training can reduce reluctance to use computers in classroom instruction (Brennan, 1991; Kolehmainen, 1992; Pina & Harris, 1993). Forcier (1996) points out that many researchers believe that one of the most effective strategies to engage teachers in acquiring the needed computer knowledge and skills is the task-oriented approach.

Computer Tasks and Instructional Enhancements

The task-oriented approach and hands-on activities have played an important part in computer application courses. However, simply having teachers conduct computer tasks does not necessarily help them master the needed skills and cope with the learning curve. With many years of experience in teaching computer applications to teachers, the author finds that there are various kinds of tasks and that some tasks are more problematic than others for certain users. These tasks may be organized into three knowledge categories. Also, several innovative instructional enhancements may be designed and developed to help teachers smoothly climb up to the desired knowledge and skill levels. These tasks and enhancements are described as in the following section.

Computer Task Categories

Conceptual knowledge. Conceptual knowledge concerns basic computer operational concepts, including how computers process information and how software operates. The following are some examples of conceptual knowledge.

- To close a document is not the same as to quit a program.
- To copy a selected range of information or data, the computer stores the information in the available memory. The size of data to be copied is limited by the size of the computer's memory.
- To format a disk is to prepare the disk for use. We don't have to format the same disk each time when we use it. The formatting process will erase the entire information on the disk.
- To include text as well as graphics elements in a certain word-processing programs, users might have to switch between the text mode and the graphics mode. The graphics inserted in the text mode will become in-line graphics that will be treated as if they were text characters.
- To enable printers to print properly, users have to specify the correct printer setup, especially if more than one printer is connected to the computer.
- To copy or delete data, users first need to select the intended data. Otherwise, the computer will not understand what to do with the given copy or delete command.

Declarative knowledge. Declarative knowledge refers to functions, features, technical terms, and their meanings. The following are some common computer terms that belong to the declarative knowledge category.

- Icon bar and ruler
- Justification
- Header and footer
- Copy, cut, and paste
- Widow or orphan

- Macro or shortcuts
- Style sheet
- Cell references
- Web browser

Procedural knowledge. Procedural knowledge refers to the intellectual steps needed to accomplish a given integrative task or to troubleshoot problems in a complex setting. The following tasks require procedural knowledge.

- Organize a newsletter
- Create a slideshow
- Customize a business card
- Make a calendar
- Develop a gradebook
- Correct some formatting errors by using the search-and-replace function
- Simplify repetitive tasks with macro functions
- Configure speech and sound for the computer system
- Convert data files with different formats

Although these task knowledge categories are fundamentally different, it is sometimes difficult to distinguish one category from another. Very often a task may require background knowledge and skills from more than one knowledge category. Anderson (1985) suggested that procedural knowledge must pass through the declarative knowledge stage. Smith and Ragan (1993) pointed out that in many cases conceptual and declarative knowledge is essential to learning intellectual skills. To enhance current computer application courses, investigations on the relationship between the types of tasks and the users' learning performances are indispensable.

Instructional Enhancement Devices

To help teachers smoothly and effectively master the intended tasks, a few instructional enhancements were designed and developed for this study. They included:

- Detailed, step-by-step information for the task.
- General information and terminology.
- Review of related tasks and features to the real-life experience.
- Quizzes functioning as formative evaluations. Quizzes are in the format of standardized tests and online computer tasks.
- Team projects.
- Model work samples/students' work sharing.
- Different types of exercises.
- Follow-along exercises provided during in-class demonstrations.
- Mock-up exercises used after class to reinforce the skills learned.
- Creative exercises (or open-ended miniprojects) given after class.
- Think-through exercises employed to engage teachers to think and to establish a whole picture of the tasks accomplished.
- Challenge exercises provided to invoke deep thinking and application. For example, teachers were asked to reverse procedures they had learned about

spreadsheet and charting, i.e., to develop a set of data based on a given chart. They were then encouraged to think about how they could use this approach to engage their students to think critically and creatively.

Purpose of the Study

The goals of this study were to gain information about the following issues:

- How do novice computer-using teachers differ from experienced computer-using teachers?
- How do inservice teachers differ from preservice teachers in computer learning?
- What kinds of devices can help novice users master computer tasks and accelerate the learning curve?

Method

Subjects

This study is based on a college-wide microcomputer application course with 36 undergraduate preservice teachers and 42 graduate inservice teachers.

Instruments

To assess students' performance, the following instruments were developed and employed:

- *Error log*. Students were asked to keep a weekly log and to report the errors they made.
- *Written quiz*. Quiz items were used to assess if students had acquired needed conceptual and declarative knowledge.
- *Final portfolio*. Students were encouraged to develop an integrative portfolio to demonstrate what they had accomplished in the course in terms of tasks reflecting teachers' needs in a real classroom setting. They were allowed to focus on tasks related to either teacher's productivity or instructional enrichments or both. The grade for the portfolio was based on student efforts, thoughtfulness of the tasks, original ideas, creativity, and levels of difficulty. The final portfolio was used to assess intellectual procedural knowledge.
- *Exercises*. Five types of exercises were implemented at different stages as needed to help consolidate students' learning experience.
- *Survey*. Students were surveyed at the end of the semester regarding the ways in which they felt the instructional enhancement devices had helped them.
- *Final interview*. The author interviewed two students from each group at the end of the semester to acquire their feedback on the course.

Procedure

Students (including all inservice and preservice teachers) started the course and rated their own computer experience and skill levels. All the students were taught in depth about the ClarisWorks and Netscape programs and were asked to work on exercises, miniprojects, and final portfolios. As the course went on, students reported on the errors they made and how much time they had spent on which tasks. Data collected also included students' quiz scores and final portfolio grades. At the end of the course, students were surveyed for their opinions about the effectiveness of the instructional enhancement devices. Two students from each group were also interviewed to provide extra information and feedback to this study. All the data collected were analyzed to address the abovementioned research issues.

Choice of the Programs

The ClarisWorks and the Netscape Navigator programs were used as the primary tools for this study because of the following considerations. Both programs were available for various platforms and were readily installed in the computer lab. In addition, both programs were considered feasible to meet teachers' computer needs. Using Netscape Navigator to browse the World Wide Web has been a popular practice so that it was though this might increase teachers' willingness to try their best for the exercises. ClarisWorks had been a popular integrated program used in the school. It can be used for a wide range of tasks that address the needs in almost every aspect of teachers' work.

Results

Student's Self-Reported Computer Experience and Skill Levels

Students were asked to rate their own computer experiences and skill levels. Based on such information, they were categorized into four groups—preservice novice (PN = 22%), preservice experienced (PE = 24%), inservice novice (IN = 40%) and inservice experienced (IE = 14%), as shown in Table 1. Some students had prior experience in using ClarisWorks and Netscape, but their experiences were not extensive enough to affect the tasks to be learned and accomplished.

Table 1. Self-rated as novice and experienced users

Computer experience	Preservice (Undergraduate)			Inservice (Graduate)
Novice	17	22%	31	40%
Experienced	19	24%	11	14%

Error Analysis of the Computer Tasks

From what students reported about the errors they made in the computer tasks, it is obvious that novice users seemed to make more mistakes in all the categories than the experienced users. The gap between inservice novice and experienced users, as shown in Table 2, is significantly bigger than the gap between preservice novice and experienced users.

Table 2. Frequency of errors made for each knowledge category as reported by students

	Conceptual Knowledge		Declarative Knowledge		Procedural Knowledge	
	Total	Average	Total	Average	Total	A
PN (n = 17)	54	3.18	73	4.29	75	4.
PE (n = 19)	25	1.47	38	2.24	35	2.
IN (n = 31)	67	3.94	89	5.24	80	4.
IE (n = 11)	9	0.53	18	1.06	15	0.
Total Novice (n = 48)	121	7.12	162	9.53	155	9.
Total Experienced (n = 32)	34	2.00	56	3.29	50	2.

Note:	PN: Preservice novice	PE: Preservice experienced
	IN: Inservice novice	IE: Inservice experienced

Student Choices in the Miniproject Exercises

Students were allowed to choose miniprojects for the creative exercises. Although they were encouraged to try the integrative tasks, many students chose to work on simple tasks, something like the mock-up examples provided in class demonstrations. As shown in Table 3, those who chose to do the integrative tasks performed better than those who did not. It is likely that those who chose to do the basic tasks did not feel comfortable or ready to do the integrative tasks. The fact that only a low number of novice users chose to do integrative tasks may have supported this concern. However, the fact that those novice users who dared to try out the integrative tasks performed exceedingly well in their final portfolio probably suggests that integrative tasks might help computer learners accomplish more.

Table 3. Practice on advanced exercise and performance

	Mean Quiz Scores	Mean score for portfolio grade
Novice (n = 48)	70.06	80.50
Basic tasks (n = 42)	69.35	79.21
Integrative tasks (n = 6)	75.00	89.50
Experienced (n = 30)	93.10	84.40
Basic tasks (n = 10)	89.30	76.20
Integrative tasks (n = 20)	95.00	88.50

As shown in Table 4, undergraduate preservice teachers seemed to have better basic skills and did well on the quizzes. However, the preservice teachers did not perform as well as the graduate inservice teachers who had more experience in the public school classroom and had better ideas of how to apply what they had learned to the portfolio tasks.

Table 4. Mean quiz scores and portfolio grades between preservice and inservice teachers

	Quiz	Portfolio
Preservice (n = 36)	87	75
Inservice (n = 42)	72	88

Students' Perceptions About the Usefulness of the Enhancement Devices

Based on a 5-point scale survey (with 5 equaling strongly agree and 1 equaling strongly disagree), students were asked to rate the enhancement devices as to their helpfulness in computer learning. The mean scores in Table 5 show that experienced users and novice users significantly disagreed on item 1, 2, 7a, and 7b, where novice users appreciated more information and simple, easy-to-follow tasks.

Table 5. Mean scores of the helpfulness of the enhancement devices to learning

Type of enhancement device	Experienced users	No
1. Detailed, step-by-step information for the task	3.5	4.7
2. General information and terminology	3.0	4.6
3. Review and relate tasks and features to real-life experience	4.0	4.5
4. Quizzes	4.0	4.2
5. Team project	3.5	4.5
6. Model work samples/group sharing	4.1	4.9
7. Exercises		
a. Mock-up exercise	3.3	4.8
b. Follow-along exercise	2.7	4.9
c. Creative exercise (open-ended project)	4.0	4.2
d. Thinking-through exercise	4.4	4.9
e. Challenge exercise	4.7	4.0

Time spent on exercise activities is a widely recognized factor in the successful accomplishment of almost any learning task. The results in Table 6 showed that those students who spent more time on the computer tasks performed better on both quizzes and the final portfolio than those who spent less time.

Table 6. Average time spent and the mean quiz scores and mean portfolio grades

Time spent (in minutes)	Mean Quiz Scores	Mean Portfolio Grades
< 30 (n = 11)	70	72
30-60 (n = 24)	68	69
60-90 (n = 35)	86	91
90-120 (n = 6)	90	96
>120 (n = 2)	95	98

Other Factors

From the interview of two students from each group, the author gathered more feedback from students about what could help them learn better. Their responses included the following:

- *Prior teaching experience is very important.* Several preservice teachers voiced their concerns that they had no ideas about what kinds of teacher tasks they could do with computers. Such concerns were not an issue for the inservice teachers. This would explain why most preservice teachers had better conceptual and declarative knowledge (as shown in their quiz scores) but did not perform as well as the inservice teachers on the final portfolio.

- *Computer access is essential.* Because both Netscape Navigator and ClarisWorks are available across the platform, a few teachers expressed their appreciation that they would be able to practice at home. Two teachers bought new computers after they took this course because they sensed that easy access would make a greater difference for their learning.
- *Don't be afraid to try something out.* To accomplish the more complicated integrative tasks, users need to possess good conceptual, declarative, and procedural knowledge. However, experienced users differ from the novice users not just in the knowledge and skills they have but also in the way they explore computer programs. Experienced computer users seem very flexible in trying out new programs and locating solutions to the challenges, whereas the novice users are mostly hesitant to try.
- *The thinking-through process is important.* Thinking-through exercises may help students develop an ability to synthesize the information they have learned in order to develop more complex integrative tasks. A few novice students were not able to accomplish the given tasks and asked for help. When the tasks were analyzed and broken into smaller pieces, these students could handle individual tasks separately without problems. After the thinking-through exercises, they understood the concepts and were able to accomplish the given tasks. The thinking-through exercise helped students master tasks and gain confidence.

Conclusion

Technology offers teachers the opportunity to become efficient at work and to conduct effective instruction. Task-oriented approaches to engage teachers in active learning about computer applications are necessary but not sufficient. Teachers should acquire conceptual and declarative knowledge as well as the procedural knowledge described in this paper. The current study examined information about computer users' behavior and the type of tasks. Novice users needed to work on all types of tasks to improve their knowledge and skill levels.

To master computer applications, users should spend sufficient time on meaningful integrative tasks. The results suggest that practicing on integrative procedural tasks might help computer learners to perform better. The results also suggest that it is important to relate the computer tasks to the practical classroom setting and to lead undergraduate preservice students to become more aware of practicing teachers' tasks.

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General Session: IEEE-CS Society Session/K-16 Computer Science

Assessing the Computer Literacy Needs of K–12 Teachers

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Key Words: professional development, computer literacy, focus group

> The IEEE Computer Society has been conducting workshops for inservice teachers (predominantly at the high school level) for a number of years. However, during that period of time, a significant advance has taken place in the overall technical sophistication of the typical inservice teacher. The purpose of this workshop is to conduct a "needs assessment" by answering the following question: What are the strengths and weaknesses in the overall computer literacy of the typical inservice teacher?
>
> To address this question, we would like to take advantage of the collective experience of NECC attendees. We suspect that NECC attendees are generally at the top end of the scale in the area of computer literacy. What do the middle and bottom ends of the scale look like? Attendees at this session will participate in a focus group designed to address these questions.

General Session: IEEE-CS Society Session/K–16 Computer Science

Teaching C++ Programming to High School Students

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Key Words: computer science, programming languages, C++, Pascal

The Advanced Placement computer science exam is currently in transition from Pascal to C++. This transition necessitates that teachers be able to adapt to a change in programming languages. In this session, we will discuss issues that seem to be important in this transition to C++. We will also focus on externally available resources supporting this transition (e.g., on the Web). This session will be highly interactive in nature, and will be designed for teachers who are currently teaching C++, as well as those who are considering moving in this direction. The opportunity for individual interaction between both sets of teachers will be provided.

Poster Session

Internet Collaboration in Support of Education Reform: A Progress Report on Two Projects

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Key Words: collaboration, online, professional development, standards

The Collaboration for Reform Project of BBN Technologies and the Northeast Regional Laboratory at Brown University is helping states in the region explore the role of online collaboration in supporting the implementation of their new state standards. The project supports a constructivist model of professional development in which teachers discuss student learning and reflect on their own practice in the context of the new standards. This summary outlines the profiles of two Northeast region online collaboration projects that were developed within very different environments.

In Massachusetts, six elementary teachers from a single school district that has adopted the Investigations math curriculum have been discussing both the curriculum challenges and the evaluation of their students' work. All teachers had existing access to the Internet within their classrooms and had used FirstClass groupware for their professional communications within the district long before they participated in the Collaboration for Reform project.

The teachers started the project in February 1997 and, using FirstClass groupware, quickly launched their exploration of the curriculum strand "number sense" in the context of implementing the Investigations curriculum. Joined by their math coordinator and supported by the BBN project staff member who moderated the collaboration, teachers examined and discussed examples of student work to look beyond simple surface ideas of computational mastery and try to understand their students' developing ideas about number and number relationships on which their computational methods were based. They supplemented the online collaboration with a series of face-to-face meetings.

In Vermont, nine elementary school teachers from five different towns scattered throughout the rural northeast section of the state volunteered to participate in an online collaboration as a follow-up to attending an August 1997 workshop. The workshop introduced the comprehensive curriculum "Developmental Approaches to

Science, Health, and Technology" (DASH). The curriculum had been endorsed by state education leaders as being in alignment with Vermont's new curriculum standards, but its adoption was voluntary.

A strong interest in collaborating with their DASH-using colleagues led some workshop participants to volunteer for the project even though they had had no previous experience with Internet technology and in some cases were still waiting for their schools to get Internet access. One such teacher was the only one from his school who took the DASH training. Without the online collaboration, he had no reasonable way to share his thoughts with other DASH-using colleagues. The motivation to work through and overcome the technology challenges was high.

A BBN project staff member co-moderated the collaboration with one of the DASH workshop teachers whose technology skills were very strong. Both moderators understood and welcomed the first challenge of the project, which was to support the teachers in their entry to using the technology. Although the first messages were sent in October 1997, using FirstClass groupware, it was early March 1998 before the collaboration developed broad participation.

General Session: Exhibitor Session/Technology Training/Staff Development

Achieving Computer Literacy and Improved Academic Performance for Least-Privileged Students

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Key Words: cross-age peer tutoring, computer literacy, Internet access

On Chicago's South Side, the Time Dollar Institute and Chicago Board of Education are testing a highly innovative pilot program to bring computer literacy and Internet access to some of the least privileged students in the nation. Students are given a chance to become computer literate, have access to the Internet (where the family can afford a phone), and improve academic performance through using curriculum software at home. Funded by the Chicago Board of Education and using computers donated by the federal government, the Time-Dollar Institute is operating a cross-age peer-tutoring program where seventh and eight graders, under the direction of site coordinators and parents, tutor fourth and fifth graders who, in turn, tutor first and second graders. The students earn Time Dollars while they tutor, learn, and mentor. When they have earned 100 Time Dollars, both mentor and tutee can take a donated computer home.

More than 1,500 computers have been distributed to children who have earned 100 Time Dollars, and there are 40,000 more being earned by kids in 63 empowerment-zone schools in Chicago. The computers have been donated by the federal government and are mostly 286 and 386 PCs and some 486s. Loaded on the computers is an innovative graphical suite of software: SchoolSuite 98—an award-winning "point-and-click" suite of applications (word processing, spreadsheet, database, drawing program, home finance application, communications, and Web browser) that is uniquely able to bring advanced computing to older computers. Curriculum software covering areas such as science, math, English, and other subjects is also installed so that students have a focus when using the computers at home. It's not just the students, though, whole families are making use of the computers—budgeting, scheduling, and using the major applications. Donated PCs and New Deal software are providing the answer to a hitherto insurmountable problem: bringing computer literacy, curriculum support, and even Internet access to students who would never otherwise have access to the tools of the Information Age.

This is the third year the program has been funded by the Chicago Public Schools and is hailed as a showcase for the "10,000 Tutors Initiative" launched by the CEO Paul Vallas and his management team after taking over the Chicago Public schools. Demand for the program has spread throughout the schools in the Chicago Empowerment Zone. Principals report that school attendance goes up every day tutoring is scheduled because the children are coming to school in order to stay after school to tutor. Teachers are finding there is less bullying in the playground because tutors tend to want to protect their tutees from harm. The older children are brushing up on basics, and some are getting the first A's and B's of their lives. Many of these students would never have an opportunity to have a computer at home without this program.

Research studies on peer-tutoring approaches have found higher levels of academic and social development gains in students compared with students in conventional learning settings. Studies have also found that students with access to a computer at home do better in school. In a study of Indiana's Buddy System, which places computers in the homes of upper elementary school students, Buddy System students demonstrated gains in writing proficiency three times greater than those of students without home PCs.

This presentation will describe in detail the program for cross-age peer tutoring: the method of soliciting donations of computers, selecting the software, and the effects of having a computer at home. Whole families become involved and learn computer literacy, a graphical suite of software similar to that used in schools and corporations. They can complete curriculum lessons on the computer and gain its effect on increased academic performance, motivation, and self-esteem. Every student should have the chance to become computer literate, as President Clinton envisioned in his State of the Union address:

> *For the first time in history, a child in the most isolated rural town, the most comfortable suburb, the poorest inner-city school will have the same access to the same universe of knowledge.*
>
> *February 1997*

Poster Session

Creating an Intranet to Deliver World Wide Web to the Second Grade

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Key Words: thematic units, World Wide Web, intranet

In this project, an intranet was set up to integrate Web information into second-grade thematic units in a lab with direct Internet access for only one computer. World Wide Web is the latest buzzword in educational technology. Incorporating it into the classroom in real learning environments can be a challenge. This project combined the efforts of a second-grade classroom teacher with a college instructional technology professor to create lessons for students to do research for thematic units.

Students used Netscape and downloaded Web sites from a server to access information. By using files instead of actual Internet Web sites, two advantages became apparent: students spent little time lost in the maze that is the Web and students did not have the chance to find inappropriate material. The effect, as far as students were concerned, was the same as the Internet, but in actuality it was an intranet.

The second-grade classroom teacher determined what units would be taught and what information students needed to have access to. The instructional technology professor created Web pages by downloading Web sites and setting up the intranet server. Both worked directly with students when the students had their lab time to access the Web sites.

The process for this project involved these steps:

1. Determine what was to be taught.
2. Search the Web for relevant information.
3. Create Web pages (some adjustment to the original was needed).
4. Install the Web pages on the server.
5. Teach the lesson.

You will learn:

1. how to download a Web site
2. how to set up a server
3. how to configure Netscape

You will also see some of the following units that were created:

Unit 1 Frogs and Toads

> This exercise was used to introduce the second-grade students to the World Wide Web. Students were shown how to use Netscape Navigator on a Macintosh.

Unit 2 Birds

> Day 1: Students were to write facts they found about the bird they had chosen.
>
> Day 2: Students chose two birds and using a Venn Diagram work sheet described the characteristics of each bird that were different and the characteristics that were the same.
>
> Day 3: Students observed characteristics they observed and had to write the facts about the birds they saw.

Unit 3 Spiders

> This lesson introduced the Find command within Netscape.

Unit 4 Alaska

> Day 1: Students were introduced to the concept of migration using a Web site about the California Gray Whale that included pages on migration, feeding, behavior, and calving.
>
> Day 2: Students accessed CNN Weather and the Weather Underground to find and compare Charleston, South Carolina (home), to Fairbanks, Alaska.

Workshop

Becoming an Architect: School Web Page Design Made Simple

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Key Words: Web design, HTML, school Web sites

Background

Larry Pinto is an instructional specialist for the Alhambra School District's Technology and Information Services Division. He possesses a master's degree in instructional technology and is completing work on an administrative credential. Alastair Aitken is an instructional specialist at Mark Keppel High School, Alhambra School District. He has a master's in educational administration with an emphasis on technology.

While both Larry and Alastair have worked with LACOE's LT&T Program and district staff development projects, and have presented at CUE, each brings his expertise for Web design through the construction of both educational and corporate sites. Both enjoy sharing this expertise with educators, enabling them to create professional Web pages for their schools.

Discover the basics of building Web pages in HTML using these tools: Netscape, SimpleText, Adobe PageMill, and Claris HomePage. Through shared ideas and samples, experience your school's Web site come to life.

During this three-hour, activity-based workshop, we will provide strategies for the architectural layout of constructing a school Web site. Innovative examples will serve to illustrate the key essentials and caveats of Web construction.

Next, we will demonstrate the basics of building a Web page in HyperText Markup Language (HTML). The following labels and their functions will be explained:

- <HTML>
- <HEAD>
- <H1>, <H2>É<H5>
- <TITLE>
- <P>
- <A HREF="http://www..."></A>
- <FONT SIZE=...>
- <BR>

- <IMG SRC=...>
- <IMG ALIGN=...SRC="...">
- Image height and width
- Borders around images
- <HR> including thickness of l

Participants will then create a template in SimpleText for their school. It will be based on fundamental guidelines for the appearance and format of Web pages.

After previewing their Web sites in Netscape, participants will proceed by opting to further develop their designs in either Adobe PageMill or Claris HomePage. Demonstrations of each of these Web editors, with their intuitive WYSIWYG environments, will be provided.

Finally, each participant will have access to handout materials, resources, references, and freeware/shareware to assist with the ongoing development of their school Web site.

Workshop

Adapting Instruction and Curriculum for Video Teleconferencing

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Key Words: video teleconferencing, adapting instruction

> Several components should be considered when preparing for instruction in the distance learning classroom. This workshop looks at the major components and how to deal with each. Great detail will be focused on planning a lesson, teaching techniques for this medium, questioning strategies, and ways to improve student interaction, as well as the preparation of visuals. Microsoft PowerPoint lends itself well to this medium; therefore, time will be spent on adapting your PowerPoint presentations for video teleconferencing.

General Session: Technology Training/Staff Development

Student Technology Leaders: Empowering Our Students to Empower Us

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Key Words: students, help desk, technology support, STLP

How do you spell technology relief in Jessamine County? STLP! Our Student Technology Leadership Program (STLP) is made up of outstanding students dedicated to improving technology use in Jessamine County. STLP members run the network, assist and train teachers, and upgrade computers. Jessamine County's motto is, "A Community of Learners ... Together We Can." We are each a learner as well as teacher.

When the Jessamine County Educational Technology Conference took place, the trainers were not all adults. In fact, most training sessions were taught or team taught by STLP members.

Jessamine County expert trainers in PowerPoint, HTML, Web searching, ClarisWorks, peripherals connecting, remote access, Windows 95, troubleshooting, interactive video usage, and so forth, are all students. Students are assigned areas to become experts. They are expected to be able to clearly explain and teach both verbally and in writing. We have found that the handouts and manuals teachers take back after training are as valuable as the training itself. Students must conduct a needs assessment and interview teachers to find out what they need to know and then design the training. The handouts and manuals must be clear, include pictures, and fit within our printing budget.

STLP's goals for next year include putting these manuals on the Web for easy access. Students are proud of the work they do in Jessamine County and we couldn't meet our goals without working together. "A Community of Learners ... Together We Can!"

In addition to the training, students provide technical repair and maintenance. They do this job through a help-desk organization. Calls come in and students help teachers over the phone or make site visits as needed.

URLs:

Kentucky STLP Academic Village
http://www.kde.state.ky.us/default.asp

Jessamine County Schools (see the Technology Cheat Sheets and Community Quilt)
http://www.jessamine.k12.ky.us/

General Session: Technology Training/Staff Development

Technology Infrastructure in Teacher Education

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Key Words: teacher preparation, professional development, technology infrastructure

The Technology Infrastructure in Teacher Education project is funded by a grant from the National Science Foundation (NSF REC-9725214) and addresses the need to prepare teachers for the use of advancing technologies by studying a teacher preparation program that has undergone substantial restructuring, is committed to a vision of a technology-using educator, and has made a substantial investment in an innovative technology infrastructure. The study advances a potential model for exemplary use of technology in a teacher education program and builds new knowledge (1) about how technology supports professional development, (2) about how professional development builds competency and capacity for using technology in teaching and learning, and (3) about the impact of a new teacher education program supported by advanced technology on the development and socialization of beginning teachers.

The teacher education program has been restructured to focus on field-based inquiry and reflective practice and to include across all phases and components outcomes for the understanding and ability to use technology. Perhaps even more significant is the investment of $3.4 million by the College of Education (COE) to build a technology infrastructure to enable a learning community and to develop new teachers who become users, advocates, and life-long learners of technology.

The technology infrastructure includes (1) a set of technology competencies for teacher education majors, (2) having each student possess a laptop computer to ensure high levels of access to technology, (3) providing faculty with advanced technology, (4) connectivity between the COE and partner school districts, (5) electronic tools for capturing, sharing, and reflecting upon experiences, and (6) the creation of new forms of support for using technology. The COE envisions a community of educators enabled by advancing technology for shared and continuous professional development. The study of this emerging environment and community is focused by the following two core questions:

1. Given the new program design and technology infrastructure, what cultural and social patterns emerge and how do they affect the professional socialization process and outcomes?
2. How does the technology infrastructure of the COE contribute to the

development of technology-using teachers?

Three data collection methodologies are underway. Each of the methods of studying the technology infrastructure and the emerging practices and social organization of the teacher education community has a set of procedures for data collection and analysis, but the integration of the views of these methods is the primary outcome of the project. The three methods are (1) a longitudinal qualitative study of professional socialization, (2) a portfolio review of the technology products of students, teaching groups, and the program, and (3) pre- and postinstrumentation to assess changes in attitudes, expectations, and practices for the key learner outcomes of inquiry orientation, reflective practice, learner-centered instruction, and technology use.

General Session: Curriculum Design/Strategies

Integrating Technology Into All the Classrooms: A National Challenge

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Key Words: classroom, elementary, middle, prekindergarten, family learning

Introduction

As more and more schools spend more and more money on educational technology, the prospects for integrating technology into the teaching and learning that goes on in most classrooms becomes dimmer and dimmer.

Can this be true? How did it happen? Can anything be done about it? There's a growing body of evidence that educational technology is becoming less and less relevant to classroom teaching and learning. Much of the money is spent on things (laboratories, wires) and people ("technology coordinators" whose classroom credentials aren't credible to teachers) that have little or no intended impact on classroom teaching and learning. The people who provide educational leadership in school systems (superintendents, principals) are often clueless with regards to how to fit technology into their visions of instructional leadership, if indeed they have any such visions. "Early adapter" teachers who do use some technology in their classrooms don't "spread the word"; their classrooms rather become isolated islands of technology in a sea of status quo ante Apple sameness.

Everywhere But the Classroom?

Even when substantial funding becomes available for the creation of new models or demonstrations of effectiveness, little of the money ends up getting spent on the core issue of how to get technology integrated into the teaching and learning that goes on in most of the regular classrooms in our schools, despite the indisputable reality that the classroom is the "crucible" where most learning takes place. The federal money distributed through the national Technology Innovation Challenge Grant program and the state-based Technology Literacy Challenge Fund is just the latest case in point. The overwhelming preponderance of funds available under these two quite generous federal initiatives are being spent on "anything but" comprehensive efforts to integrate technology into regular classrooms.

Sure, some of these projects involve some classroom teachers (mostly early adapters), but very few even try to reach all or most of the classroom teachers in a single school or entire school system. Yes, some also pay considerable attention to professional development activities for some classroom teachers, but far fewer of these carry through these professional development efforts back to the teachers' classrooms. Only rarely do they involve all the teachers in the same school or all the teachers in the system at the same grade level.

One Working Model

One exception is the Teacher Led Technology Challenge (TLTC), in Berkeley, California, which is just completing its second year of operation under a five-year federal Technology Innovation Challenge Grant. The TLTC project offers a comprehensive model for whole school and " whole system" classroom technology integration, a model which is already being adapted in various ways in several other California school districts.

The Berkeley TLTC seeks to harness new technology tools in the service of improved teaching and learning within the arena where most school learning takes place: the regular, "self-contained" classroom. Teachers in every regular prekindergarten, elementary, and middle school classroom learn how to (1) regularly integrate multimedia instructional materials in core subjects like reading, mathematics, science, and writing, (2) exploit the value of technology tools in accommodating the neglected learning styles and needs of struggling students, and (3) harness technology tools to promote "higher order" instructional goals recommended by national curriculum standards groups like NCTM.

The TLTC seeks to promote the following outcomes:

1. Classroom teachers who learn more about how to use technology
    a. to accommodate a greater range of learning styles
    b. to help all students master the core skills emphasized in the curriculum
    c. to structure classroom experiences that involve cooperative learning, cross-age tutoring, increased student initiative and higher order thinking.
2. Students who can use available technology tools to gain a deeper understanding of the subjects they study and greater confidence in their own learning abilities, and who can demonstrate higher levels of attainment in core basic skill areas.
3. Parents and other family members who learn how to promote enjoyable, classroom-relevant instructional experiences around a computer in the home.

Key features of the strategic design include:

- The training and development of regular classroom teachers in each school as technology integration leaders ("lead teachers") within their own building, in a peer-to-peer support model
- A unique "menu" of professional development options that enables teachers to

select the kinds of inservice activities that best suit their own individual learning styles
- An incremental, three-stage implementation process that allows teachers in each participating school to join the project when it is most comfortable for them, and to then move forward from whatever level of technology sophistication they bring to the project to higher levels of understanding of ways to integrate technology into regular classroom learning
- A major emphasis on the use of multimedia technology tools in developing emergent literacy skills among educationally disadvantaged prekindergarteners
- A loan program that deploys school computers and good learning software into the homes of youngsters who are most likely to benefit from increased time on enjoyable computer activities every weekend, school vacation, and summer
- An outreach program to family members that makes it easy for them to learn how to use technology to help these youngsters learn

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Workshop

Patterns, Probability, and Problem Solving With Spreadsheets

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Key Words: spreadsheets, laptop, middle school, critical thinking

Imagine all of your students having their own laptops in just a few short months. In this vision the students won't be using "educational" software and learning games, but instead they will be using the laptop as a production tool in school and at home. They will be using Windows 95 and Microsoft Office Professional to prepare their class work, homework, special projects, and presentations.

As a math teacher at McCracken Middle School in Beaufort County, South Carolina, I was faced with this scenario. In the fall of 1996, 120 sixth-grade students on my team entered into three-year leases of Toshiba laptops as part of the Anytime, Anywhere Learning program (formerly called Learning With Laptops) piloted by Microsoft and Toshiba. This year the program expanded, tripling the number of sixth graders and seventh graders carrying laptops to class.

Students entering this program had a limited knowledge about spreadsheets, at best. They soon learned to record data, write basic formulas, and produce tables and graphs within the framework of the existing sixth-grade curriculum and local and state standards. The spreadsheet became a tool they could manipulate to solve problems. My job as the teacher was to locate and adapt lessons for use on a spreadsheet.

The use of the spreadsheet promotes the development of higher level thinking skills. One of my favorite activities is to work with number patterns and functions. Students enter a pattern into a spreadsheet from a problem in their textbooks. One such pattern might include the terms 1, 3, 5, 7. Students are asked to extend the pattern. This could be viewed as an elementary problem if all the students merely had to do was type in the next terms in the pattern. However, the problem takes on a new dimension when students have to determine a formula to instruct the computer to do the calculation. Once the formula has produced results, the students then must evaluate those results to see if they meet their expectations.

Graphing, too, requires that students engage higher level thought processes. With a click of a button, students can have any number of impressive-looking graphs. Students must evaluate their product to determine if it is the appropriate type of graph, and more importantly whether it is dealing with their data in the manner they anticipated. In working with my students I always ask them to decide in advance what answer they expect the computer to generate or what their graph should look like. The laptop forces the student to critically judge the graphical data for correctness. This is a tough task, but it is guaranteed to enhance reasoning skills and the development of a number sense.

The infusion of technology into my class has helped my students become excited about learning. They are producing work of the same quality found in businesses and are engaged in real-world cooperative learning situations. My students are learning how to manipulate today's technology, and they will be effective in tomorrow's workplace.

General Session: Laptops

My Students All Have Laptops: Now What?

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Key Words: laptop, curriculum, integration, middle school

The chill of a December day was eclipsed by the energy and excitement of 120 sixth-grade students bringing their own laptops to school for the very first time. The teachers surveyed the halls with differing degrees of anxiety, silently questioning their abilities to deal with the sudden infusion of technology into their classes. Within a week we were more comfortable with laptop learning than we had ever dreamed possible! We were as excited as our students.

Program Overview

Beaufort County School District in Beaufort, South Carolina, entered into a pilot program with Microsoft in the fall of 1996. Over 300 sixth-grade students in three middle schools contracted for three-year leases of Toshiba laptops preloaded with Windows 95 Plus and Microsoft Office Pro as part of the Anytime Anywhere Learning program. This year the number of sixth- and seventh-grade students who are carrying notebook computers to class has tripled. To provide equal access to the technology for all students, the newly formed Beaufort County SchoolBook Foundation has subsidized the monthly lease payment for qualified students. This nonprofit organization was formed by interested community members to oversee the program and raise critically needed funds.

Community Snapshot

Beaufort County is located in the southeastern corner of South Carolina and includes the historic city of Beaufort and Hilton Head Island. The economy is tourism-based, with additional employment generated by two military installations. Our population, at approximately 105,000, is growing rapidly with the development of Sun City and other large housing developments. The student population is currently at 15,500, growing by about 500 students per year, with an ethnic ratio of 50% majority and 50% minority. In a 1995 referendum, county voters approved $122 million for school construction and the implementation of a comprehensive technology plan. Each district school was allocated a proportional share of the technology funds to develop the infrastructure (servers, cabling, routers) and Windows-based hardware/software. Each site has a local area network (LAN) with multiple servers, CD-ROM towers, and Internet access. Each LAN is connected to the district's wide area network (WAN) and thus to the South Carolina Information Network.

What Do We Expect?

Our teachers have received training to integrate the laptop into the curriculum. The immersion in technology will allow our students to demonstrate:

- improved skills in problem solving, critical thinking, spelling, writing, and math reasoning, and increased motivation and responsibility for their own learning
- more time on learning tasks and greater personal productivity
- greater understanding of and proficiency in using computers and software applications
- improved collaborative skills
- acquisition of real-world life skills in a learning environment

The Reality of a Laptop Classroom

Our first weeks with laptops were spent introducing the basics of Windows 97 and the productivity software. Applications were performed as much as possible within the context of our normal curriculum. Documents were created in different classes and saved in folders created for each subject. We guided students through options in the control panel and had them set the time on their computers, if necessary. We also had them change the settings for their cursors, as we have found that adding a trail to the cursor makes it easier to locate on the laptop screen. Lessons were provided to the students on disks, requiring that they open the file from the disk and save it on their hard drive. Within a few weeks we were back up to speed in delivering our standard curriculum, while integrating this readily accessible technology.

However, long before this could become a reality, the groundwork had to be in place. Supporting infrastructure—electrical wiring, surge protectors, and network connections—was purchased and installed. Peripheral equipment enhanced the program. Priorities had to be determined for the purchase of printers, projection devices, scanners, network cards, hubs or wireless connections, and digital cameras. Security needed to be addressed. Our students store their laptops in cubbyholes in a secured room when they are not in use. The district has also purchased anti-theft security tags, which are affixed to the laptops. The tag warns that if it is removed, it will leave a "tattoo," alerting a potential buyer that the laptop is "stolen property." Additionally, each laptop's serial number and tag number are recorded in a national database, allowing it to be tracked if ever stolen or resold. We also counsel our students about safety concerns when carrying and using their laptops at school, on the bus, and out in the community.

Technical support begins with the teacher in the classroom. When the problem is beyond the scope of the teacher or eager and knowledgeable student helpers, the laptop's problem is evaluated by in-school technology teachers. They have ready access to district-level support. Parents have numbers for help lines for Toshiba and Microsoft. Recognizing the absence of a local authorized Toshiba repair center, the district entered into an arrangement with a premier Toshiba service provider in Virginia. Families experiencing technical problems can use a special mailer to send their computers for repair at no cost to the family, except for repairs not covered under the warranty. The district has also purchased an insurance policy to cover theft, loss, and damage. Loaner computers are sometimes available until student machines are repaired and returned, usually within four or five days.

Newly Defined Teacher Roles

During the first week with laptops, one of my colleagues came rushing into my room. She grabbed my arm, slightly shaking me, and told me, "It's all right!" When I asked her to expand upon this, she explained that she had just told a student that she did not know how to do something on the laptop, and it was O.K. When faced with the prospect of teaching out of their "comfort zones" many teachers fear the loss of control. They find it difficult to say, "I do not know." When it comes to technology, if the students don't already know more than we do, they soon will. Teachers have to accept this reality and use it to their advantage.

The teacher needs to examine the curriculum and determine how the technology can enhance existing standards and objectives. The laptop lends itself to collaboration among students and peer teaching. In fact, the role of presenting information often shifts to the students. The teacher assumes the role of facilitator, directing the students instead of dictating to them. I find that my students are excited about learning, are producing work of the same quality found in businesses, and are actively engaged in real-world cooperative learning situations. My students are learning how to manipulate today's technology, and they will be ready to effectively operate tomorrow's.

Workshop

Using Microsoft Office to Author Web Pages

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Key Words: Internet, Web, authoring, Microsoft Office, textbook

Why Use Microsoft Office to Create Web Pages?

Increased access to information via the Web (intranet and Internet) and the exponential growth of electronic mail is generating a wealth of information. Today's businesses and industries are struggling to keep up with this ever-changing technology and are looking for methods to simplify information distribution.

Until recently, creating Web pages required some technical skill, and employers were forced to employ specialists to create these documents. This was a time-consuming chore and prolonged the information assimilation process. Now, however, the Web publishing features of Office make it quick and easy to create and design an HTML document. Basically, anyone with rudimentary Office 97 skills can convert their documents to HTML for publication on an intranet or the Internet. Furthermore, Office 97 supports true WYSIWYG editing of HTML features and allows users to preview their documents without switching to the browser.

The Office 97 Web authoring tools makes working with HTML documents easier than ever. With the Web authoring features, Office 97 users can use their formatting skills, publish their documents to a Web server from any Office 97 application, check for broken hyperlinks, and create great-looking pages with new templates, styles, and backgrounds. The conversion Wizard enables the user to select a common background and common elements for converted documents.

This is a hands-on workshop where participants will have an opportunity to use the Microsoft authoring tools to create Web pages. These tools are built into Office 97 and/or can be downloaded from Microsoft's Web site for older versions of Office. Participants will receive a copy of Dolores Pusins' book *Using Microsoft Office's Web Authoring Tools*, published by QUE E&T. For those interested in an evaluation copy, contact Matt Crispin at 1.800.571.5840, ext. 6288.

The workshop begins with a short introduction to Web site design and an overview of basic HTML tags. Following that, workshop participants learn how to use the Web Page Wizard or the Blank Web Page template in Microsoft Word to create their own Home pages.

By using the Insert Hyperlink button on the Standard toolbar, students learn how to quickly create hyperlinks to link related information in different locations. They will also learn how to enhance their page by creating special graphical bulleted lists and horizontal lines.

Graphics make a Web page special. Participants will have an opportunity to use a digital camera and include their own picture on their page. Using PaintShop Pro (shareware), they will learn about the different graphic formats and how to create their own personal logo to add to their page. The more advanced student will have an opportunity to use the GIF Construction Set (shareware) to create some simple animations.

An added feature is that every Office application has the Web toolbar, which works the same within each application. At the completion of the workshop, the participants should leave with enough knowledge to apply their skills to the other Office applications.

Dolores Pusins, program manager and professor of computer science, at Hillsborough Community College in Tampa, Florida, will give this presentation. She has given workshops and presentations at previous NECCs. She presented a paper and a six-hour workshop on HyperStudio for Windows at the Minneapolis conference in 1996 and two 6-hour workshops (HyperStudio and Word) in Seattle in 1997. She has written textbooks for several publishing companies and authored chapters for other computer science books.

An MCI online white paper states that the "use of Office 97's ability to save as HTML has doubled their intranet component since deployment."

General Session: Technology Training/Staff Development

Staff Development at the Center of Change

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Key Word: staff development

It is generally recognized that staff development in the area of technology is significantly different from that of previous years as the influx of computers contributes to drastic changes in the nature of school. This session will present a carefully structured plan that includes a tool for assessing teachers' current level of basic computer skills, strategies to achieve intended results, a curriculum designed to teach teachers to use computers to manage school tasks and to improve the educational experience of the students, and a method of addressing the changing organization of the schools in which the teachers work.

Washington Township Public School District (10,000 students) has recently completed a plan to provide computers to all of its teachers as part of a large-scale computer infusement project. In 1997, new computer labs were built in each of six elementary schools, three middle schools, and a 3,000-student high school. Computers were installed on the desks of more than 350 teachers. Expectations were that the teachers would use the computers for three purposes: to handle the "business of school" (attendance and grades), to teach with computers (CD-ROMs, presentation of lessons, student projects), and to access the Internet. To ensure that the computers would be used for these three goals, an extensive staff development program had to be devised to measure the existing level of expertise, design appropriate workshops, schedule training, assess learning, and address the changing culture and structure of the organization of the school district itself. The following steps were taken:

1. Determination of "minimum basic computer skills" for all Washington Township teachers. ISTE guidelines and a general familiarity with the experience of the staff provided direction for developing a list of skills. Word processing, the use of a computerized grade program, familiarity with teaching techniques and educational software critical to the utilization of the computers for other than a record-keeping tool, and basic troubleshooting techniques deemed essential to avoid the dependence on an understaffed support team formed the basis for the list.
2. Once the minimum basic skills were identified, an assessment tool was created to determine the level of expertise of the staff. This survey consisted of a check-off list detailing the skills mentioned above. The survey was designed to encourage beginning (and reluctant) computer-using teachers to

feel comfortable assessing themselves and to feel confident that the skills expected of them were not beyond their perceived capabilities. The survey was distributed on the first day that teachers returned to school in September with a one-week deadline to return. Administrators explained the importance and purpose of the survey.

3. Once the surveys were returned, an assessment of the actual skill level of the teachers was made. Level One skills were selected as a first-year goal for all teachers in Washington Township. Because there was a relatively large number of noncomputer-using teachers, many of the skills in the survey were postponed until after the first year. All teachers received copies of the Level One expectations and understood that this was a district goal for the first year of the program.
4. In order to achieve the goal of Level One for all teachers, a site-based staff development program was planned for individual buildings. A committee consisting of the building computer teacher, the building principal, the district director of educational technology, and the district curriculum coordinator evaluated the needs for the each building's staff. The district computer teachers were approved by the board of education to teach a reduced class load in order to make them available during the day for assistance and small-group instruction focusing on Level One skills. A district-wide steering committee planned additional staff development days to address technology skills across the district. Beginning users were permitted four half-days of substitute coverage in order to schedule workshops during the school day.
5. The District Computer Institute was expanded from 30 sessions to offer more than 140 workshop sessions. These two-hour workshops were scheduled after hours, evenings, and Saturdays. District computer teachers and staff members skilled in presenting workshops to adults taught their colleagues using a curriculum designed to address the Level One skills. Additional workshops were offered for advanced computer users looking to expand their skills. Teachers attending a total of 16 hours of after-hour classes received 1 CU credit. Instructors were paid $100 to teach a two-hour workshop.

Critical to the success of the program was the involvement of the superintendent, central administration staff, building principals, and high school department chairs. A series of administrative workshops scheduled and taught by the superintendent helped to address the problems and issues accompanying change. A team approach was essential.

It is almost the end of the first year, and most K–8 teachers have reached Level One. Problems encountered in the high school included delayed access to computers, network failures, and software glitches. Level Two skills are presently being determined for next year, with a clearer understanding of realistic expectations based on past performances. We will continue to offer workshops and training opportunities based on goals and needs. More opportunities will be provided for teachers to meet to discuss problems, issues, insights, observations, and progress as the broader implications of professional development are realized.

Poster Session

Making Classroom Technology Integration Easier: Lesson Plans That Work

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Key Words: PlayBooks, curriculum, cooperative learning, Constructivist, reading, math, integration

Come see PlayBooks developed and used by Berkeley, California, teachers. The 20 grade-level PlayBooks contain more than 300 software-specific lesson plans for integrating technology into the pre-K–8 curriculum.

The Teacher Led Technology Challenge (TLTC) began in October, 1996. It is one of the more than 60 projects in the United States that comprise the National Technology Challenge Program. This project is helping teachers in every Berkeley pre-K–8 regular education classroom use a range of technology tools to teach the core curriculum to all children, including those with diverse learning styles and needs.

It has as its single, only, and exclusive focus the integration of technology within the regular classroom. The project works exclusively with, and through, those regular classroom teachers who bear the responsibility for delivering instruction.

Berkeley's TLTC participating teachers have developed more than 20 grade-level specific PlayBooks. The more than 300 activities in the PlayBooks are designed to enhance the curriculum being presented in classrooms and promote cooperative, project-based, Constructivist approaches to classroom technology integration.

The PlayBooks are entitled:

- Math PlayBooks, K–5
- I Love Reading, K–4
- Writing and Reporting About History and Literature, 4–8
- Cooperative Learning, 4–8
- Science Inquiry, K–5
- Engaging Disaffected Learners, 4–8
- Prekindergarten Technology Resources

This poster presentation will showcase the development and use of PlayBooks through:

- descriptions of the PlayBook development and evaluation process

- descriptions and pictures showing PlayBook use, including:
    - students and teachers using PlayBook activities
    - classroom instructional technicians helping teachers and students
    - enhanced learning for students in a multi-ethnic community
    - full-inclusion students using PlayBook activities in regular education classrooms
    - bilingual and ESL students learning in a technology-rich environment

An electronic poster presentation using Microsoft PowerPoint shows the step-by-step process of PlayBook development and classroom technology integration.

Participants will walk away with a written description of the MathLand PlayBooks and the names of the software pieces included in them. They will also receive one or two examples of individual MathLand PlayBook activities. Samples of PlayBooks will be on display to be examined by participants.

General Session: Curriculum Design/Strategies

Memphis Kids 'n' Blues: An Arts-Based, Cross-Disciplinary, Multischool Collaborative Model

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Key Words: arts, music, MIDI, multidisciplinary, Memphis, blues, Co-NECT

In this project, a diverse group of teachers, students, interested parents, and local music industry representatives are collaborating on a large-scale activity about the history of the blues, with a special focus on Memphis' role. The project, which stresses the importance of integrating arts-based curriculum fully with other core topics, blends deep study and research practices with many technologies—computer, audio, and musical. It makes use of cross-age tutoring and teaches music, electronic music techniques, history, journalism, language arts, social studies, and commercial production techniques, resulting in a series of audio compact discs and a series of highly visible and exciting public performances. It also establishes an ongoing mechanism for similar projects to occur in following years.

Elementary students and their teachers in seven Co-NECT elementary schools (Co-NECT is a New American Schools design for whole-school reform with integrated technology originally founded at BBN Learning Systems and Technologies) study the blues, including history, musical structure, and cultural and social context: The curriculum material is articulated with the district's performance standards in language arts, social studies, history, and the performing arts.

Each of the schools was assigned a particular blues category or stylistic period, and all study within each school pertains to their assigned segments. Because of separate foci, students become experts on a period of blues history and reflect that expertise through classroom projects and reports. Concentrated study of a particular genre in this fashion teaches the importance of learning one area deeply and challenging different sources. Too often, projects attempt to span far too much breadth; thus, students don't learn how expertise develops in any single thing.

During each of the two years, the elementary students wrote blues lyrics during the fall, which were then set to original music composed by musicians from Overton High School (an arts magnet school). The original music reflects the stylistic study the high school students have done using source material such as music CDs and videos.

The music was recorded at another Memphis high school, Kansas Vo-Tech, and the graphics are being produced at Overton High school as a project in their graphics arts class. Proceeds from CD sales and benefit performances will be used to purchase additional electronic music equipment for the district and for ongoing project funding.

The first CD musically describes selected styles ranging from the Work Song through the Memphis Blues to Rock and Roll, and details the history of this critical music. The second disc emphasizes the particular tensions between blues and its undeniable influence on Rock and Roll and nearly every other popular American music form of this century. The CDs are produced to marketplace standards and will be recognized for their content and quality rather than for their student-project novelty. Teachers anywhere will be able to use the discs as teaching tools during their own music or history lessons.

Besides music performances and the recording, classroom activities throughout the year have included thorough reporting on history and social studies pertaining to the blues, looking at racial history through music, creating maps of everything from the Mississippi Delta to Beale Street, geography components, mathematics components, and construction projects such as building a juke joint and dioramas. Students have read and researched widely using many types of media, including online resources and CD-ROMS.

Learning Focus

This project shows conclusively that the arts are an integral part of all learning, not a stand-alone subject relegated to a few with mysterious talent. The tenets of R3A, or Reading, Writing, Arithmetic, and Arts, enable full integration and collaboration across disciplines. The music teachers worked very carefully with classroom teachers in language arts and history activities. Classroom teachers began learning that they could teach musical ideas themselves and use them in their curriculum to support the research.

All students involved in the project study the blues, a music that Memphis helped shape. Students learn from original sources and discover how the music of one culture became the music of another. In addition, students are engaged in a number of other interdisciplinary activities that are directly related to the district's emerging performance standards across the curriculum. These activities include researching the history of the blues, creating original lyrics, writing liner notes and producing artwork for the CDs, writing program notes for the performance, and preparing project budgets.

Technology is used at every turn, but never identified as a learning goal. Co-NECT schools integrate technology into the school learning environment without identifying it as something extraordinary. In addition to using common classroom technologies such as Web page authoring, HyperStudio, and Web-based research, students do learn special technology pertinent to music and the recording industry, including important ways in which technology itself greatly affected the development and direction of this art form. Most importantly, students learn key workplace skills, such as how to communicate with a variety of audiences, how to work in teams, the importance of revision, and how to achieve high marketplace standards, even at the elementary school level. Additionally, students engage in real marketing, budgeting, publicity, and production exercises, all of which have direct implications in the project's success and the district's performance standards.

Goals: A Replicable Model

This project shows how in-depth focus of a cultural or art form topic can guide the study of countless disciplines with real-life and substantive ramifications.

Teachers elsewhere will want to learn from this model and transpose it to topics relevant to them or their students. Plans include instantiation of a similar project in the Dade County schools.

The project and design are documented and available to Co-NECT partners in a Web-based template.

Kids 'N Blues was funded by a two-year grant from the BellSouth Foundation with additional support from BBN Co-NECT. In 1997, it was nominated for inclusion in the National Report on Best Practices from the President's Council on the Arts and Humanities.

Workshop

The Newest Multimedia for the Internet

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Key Words: Internet, multimedia, hypermedia, authoring, interactive, plug-in, Logo

Welcome to the incredible world of MicroWorlds—the only multimedia software that allows students as young as first graders to create truly interactive Internet projects. A truly interactive Internet project contains real-time animation, graphics, sound, music, QT movies, and/or text that can be controlled by live buttons and other input. Through the use of a new plug-in from LCSI, students can not only create and post interactive projects on the Internet but also can visit those projects or the interactive projects of others, and actually control the projects using live, real-time input. A special name is given to truly interactive Internet projects—Active Essays—and participants will view two examples directly from the Internet. No current software can produce and control Active Essays except MicroWorlds.

Those who attend this workshop will spend three hours building and operating Active Essays using MicroWorlds:

1. Introduction to MicroWorlds

   Participants will be introduced to the text, drawing, music (original and recorded), graphic (original and computer-supplied), animation, video clip, Logo programming, and slide-show capabilities of the software.

2. Introduction to Active Essays

   Participants will be introduced to interactive Internet projects (a.k.a. Active Essays) at the LCSI Web site (http://www.lcsi.ca). Students will be able to control the Active Essays from their computer stations using the new LCSI Plug-In. The two Active Essays may be found at the following Internet locations:

   http://el.www.media.mit.edu/groups/el/projects/emergence
   http://el.www.media.mit.edu/groups/el/projects/circles/contents.ht

3. Creating Active Essays

   Each pair of participants will be given 45 minutes to produce their own Active Essay on any topic of their choice. This Active Essay may be posted on their own Internet Web site or saved on disk to be taken back to their schools.

4. Conclusion

   Participants will view the Active Essays of their colleagues during a short walk-around-the-lab. Questions about MicroWorlds and Active Essays will be answered. Each participant will receive a free CD-ROM with a sample of MicroWorlds, and door prizes (two full-version sets of MicroWorlds) will be drawn for and awarded.

To view more MicroWorlds projects on the Internet, check the following:

http://www.icr.com.au/~cdkerwin/microworlds/
http://www.powerup.com.au/~dpotter/mw/fmwproj.htm
http://www.atlantic.net/~caggiano
http://scclc.sancarlos.k12.ca.us/seminars/logo/logo.public/brianc/
http://scclc.sancarlos.k12.ca.us/seminars/logo
http://204.72.208.137
http://www.computerpals.on.ca/~pals
http://www.magmacom.com/~dsleeth

General Session: Curriculum Design/Strategies

Making It Work: The Hypertext Dance in Everyday Classrooms

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Key Words: Internet, HTML, strategies, troubleshooting, hypertext, standards

Is your student:Internet connection ratio 1000:1? No money for software, let alone hardware? Feeling like roadkill on the information highway? Learn strategies to move forward with limited resources in the Information Age.

Background

We have struggled over the last two years in a suburban school that has too many students, few computers, and a single phone line to connect our entire community to the Internet. This small group of determined educators has persevered, challenged at every turn by the hallmarks of "traditional" education. We have often worked without the central systems support one might wish. Despite what seemed like impossible odds, the teachers at WMS have made it work! Kids are learning to create their own places in our global community by publishing on the Web.

How We Did It

Much of our progress has occurred after learning to do the "hypertext" approach to every life in the classroom—we have hit the back button more often than not. We would like to share some of the strategies we have used to make technology an asset for our community, and the ways we have found to make it work.

General Strategies for Making It Work

- Plan ahead
- Identify the scope of your project. Begin with your educational objectives—what you want the kids to be able to accomplish. Make a list and check it twice.
- Cross-check your objectives with your district's standards of learning. Be sure you've included subject *and* technology objectives
- Identify the tools you need to do the job. Be creative and inventive.
- Student grouping can stretch scarce resources. Rotating groups can take advantage of equipment shortages.
- Refer back to your original objectives; it's easy to get side-tracked.
- Test your project. Ask several students for input before involving the entire class.
- Connect classroom projects with a building-level plan to create a learning continuum for students.
- Develop contingencies
- Plan to create as you go; a change in plan is to be expected.
- Have several different ways to accomplish your project.
- Be prepared to throw all plans to the wind and wing it!
- Build a network of support.
- Communicate with colleagues within your school, at other schools across the country, and around the world. Talking through issues often reveals the answers you already know!
- Locate community resources and develop ways to access expertise when needed.
- Don't underestimate the value of electronic networks for solving problems!
- Keep it simple.

Acquire the basics—minimal hardware and software configurations. Here's a start:

- Software—Netscape and Notepad (an accessory within Windows). HTML is free or almost free.
- HTML files and graphics can run from a floppy disk.
- FTP through the DOS prompt is free and available on every PC.
- WebWhacker, a backup for Web resources, is valuable.

Become a troubleshooter.

- Develop an "I can" spirit. To make this work, you have to take the attitude that you can do more than you realize. Think about how the children approach a challenge.
- Don't be afraid of computers. Things do break, and they can be fixed. Take risks!
- Make friendly competition work for you. Have a sense of humor.
- To be successful, it's important to get folks to take pride in their work—to

own the results. Expect territorial issues to arise as a side-effect, and plan ahead for this.

Measure student progress so that you know if it's working.

- Create portfolios of students' work—are they meeting standards?

Publicize your success.

- Resources/Web links

Here are some resources we consult on a regular basis:

- Middle Schools
    - Sutherland Middle School
    http://pen1.pen.k12.va.us/Anthology/Div/Albemarle/Schools/Sutherland/
    We have used this school as a model for developing our resources. It is helpful to watch as they grow, and we adapt their strategies to our own set of circumstances.
    - Kathy Schrock
    http://www.capecod.net/schrockguide/
    This great collection of links helps us get started when investigating a particular topic.
    - Baltimore County Public Schools, Middle School Disciplines
    http://www.bcpl.lib.md.us/centers/education/LibraryWeb/middle/middle_scho
    This is another great collection of links.
- Educational Technology Resources
    - From Now On
    http://fromnowon.org/
    Helpful in developing an approach to lessons, figuring out educational objectives, and anticipating issues.
    - Indian Hill Treasure Hunt—Internet Skills
    http://www.ih.k12.oh.us/treasure/
    Fun way to introduce search skills.
    - Assessment of Engaged Learning
    http://www.ncrtec.org/capacity/profile/profwww.htm
    How are you doing?
    - WebQuest
    http://edweb.sdsu.edu/webquest/webquest.html
    Very helpful in providing an organizational model for creating lessons.
    - History and social science resources—SCORE
    http://www.rims.k12.ca.us/SCORE/

General Session: Technology Training/Staff Development

You Can Teach "Old Dogs" Without Wielding "Big Sticks"

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Key Words: teacher education, intermediate grades, university/elementary school partnership, thematic units

Background

Until the late 1980s, faculty members at Indiana University Southeast were slow to acknowledge the need for the infusion of technology into the elementary methods courses. With a little encouragement from a colleague, however, the language art and reading methods instructors decided to change their courses so that future teachers would truly be prepared for the classrooms in which they would find themselves.

The university professor's first attempt at incorporating some "new tricks" involved the teacher education students teaching thematic units that incorporated some word processing and Logo. At first the university provided the leadership in the area of technology. Computer workshops were held for university faculty and students to attend together, as the "old dogs" and the students learned the software. The veteran elementary teachers learned about technology as they observed the university students teaching their units. Now, however, the children and teachers at Galena Elementary School are making many decisions that "drive" the university's program.

Technological Leadership From Galena

Two years ago, Galena Elementary School received a Buddy Grant from the Corporation of Educational Technology, which enabled every fourth and fifth grader's family to have a computer and modem. The grant has enabled the fourth- and fifth-grade teachers at Galena—all of whom have taught at least 20 years—to attend workshops and conferences and collaborate with other "Buddy sites." These teachers now model the use of technology in the classroom for veteran and preservice teachers and give presentations at conferences. They even hold a summer Buddy Camp to help families learn to use technology. The school maintains a home page on their intranet, and almost daily the children at Galena problem-solve and engage in the writing process as they prepare e-mail, multimedia research presentations, stories, and other classroom projects.

Teacher Preparation Today

As of the late 1990s, the college students teach literature-based units that incorporate comprehension strategies, the writing process, poetry, study strategies, Web sites, "life skills," and a student-created multimedia presentation.

Now the elementary school loans laptops to the university students. The children come to the campus for a "Professor for a Day" event and teach the college students about the laptop and its software. The university students and the children also correspond by e-mail. In addition, some of the children and the college students are "Webytes"; they engage in research and then spend a day on the university's campus and create collaborative Web pages.

Closing

Not any of the teachers or faculty members involved in the Galena project are or ever have been "techies." Based on the data we continue to gather, however, we recognize that technology is playing a significant role in our preparation of students, both future teachers and children. We have never needed "sticks" to promote technology—just risk-taking and progressive educators willing to challenge their beliefs about teaching and learning.

General Session: Technology Leadership

More Voices From the Global Village

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Key Words: international, communications

This year, Cathy and Margaret traveled to the mountains of Spain to interview teachers from 38 countries attending the annual conference of the International Education and Resource Network (I*EARN) (http://www.iearn.org). Nineteen "voices" from 18 countries will tell you about what is happening with telecommunications around the globe. The video is organized around five topics:

1. Collaborating Overseas
2. Using Students as Resources
3. Finding Funds From the Community
4. Bypassing the Barriers
5. Students Making a Difference

We hope you will enjoy this way of extending international participation at NECC.

1. Collaborating Overseas

We begin with a description of the many projects that students and teachers have undertaken to help create a global community of learners.

Professor Anna Grabowska

Distance Education Manager
Distance Education Centre
Technical University of Gdansk
Gdansk, Poland

This first-year participant has great enthusiasm for the three "absolutely magnificent American projects" that she and her students are involved in: ThinkQuest, I*EARN, and two National Geographic Kids Network curriculum units. Anna eagerly wishes to work with others on these and other projects. A few months after the video was taped, one of her ThinkQuest teams made the finals, so they were flown along their coach (Anna) to Washington, D.C. for five days of judging, sightseeing, and demonstrations of the latest advances in telecommunications.

You can see the entry of Anna's team at http://library.advanced.org/10241/. For further information about the projects mentioned by Anna Grabowska, contact these nonprofit organizations:

- I*EARN's vision and purpose is to enable young people to undertake projects designed to make a meaningful contribution to the health and welfare of the planet and its people. Projects within I*EARN that are mentioned include Learning Circles, YouthCaN, the Holocaust/Genocide Project, the Power of Math, and the Indigenous People's Art. http://www.iearn.org/iearn/.
- National Geographic Kids Network is an easy-to-use, eight-week, telecommunications-based science curriculum for Grades 3–9 that meets national standards. It enables students to explore real-world topics, such as How Loud is Too Loud? and Is Our Water at Risk?, by doing exactly what top scientists do—conduct experiments, analyze data, and share results with peers worldwide. Catalogs are available from ngshotline@aol.com.
- ThinkQuest is an international program that encourages students to use the Internet to create Web-based educational tools and materials that make learning fun and contagious. Structured as a contest—with more than $1 million in prizes—the ThinkQuest program encourages students on different levels of the information technology ladder to form teams to build their educational materials. The contest is now worldwide and encourages both elementary and secondary students to participate. http://www.advanced.org/.

Rafael Alvarez Mart'nez

Asesor y profesor en computacion educativa
Centro Educativo Jardines de la Hacienda
Querétaro, Oro, México

"We try to have the children have the same experience with computers as they do, for example, on this very pretty playground," said Rafael. Children treat the two computers in the school as an activity that's fun; the computers are integrated into all of the classrooms and projects, not separated into computer classes. One significant project was in reading and writing Spanish in which the children wrote stories by hand, read them aloud, then typed them into the computer. They were easily able to revise and to create a professional looking book of their stories. The parents were invited to the school and given copies of the books, and the children showed them what they had done. Rafael's class has a partner class in Oregon with whom they exchange e-mail and packages of typical things of their cultures.

Profesor Enid Figueroa

Director, Orillas a Orillas Project and I*EARN Center in Puerto Rico
Faculty of Education
University of Puerto Rico
San Juan, Puerto Rico

Students in Puerto Rico, Mexico, and the Catalonian region of Spain worked together on a project exploring the connection between math and the real world. These students exchanged e-mail, participated in conferencing, and sent packages of artwork about their countries through the regular mail. In the math project, ultimately, the children discover, "math is in every part of their lives." For the past 10 years, Enid and the University of Puerto Rico have worked with teachers and students to use the Internet to collaborate on projects with students from other Spanish-speaking countries, including bilingual classes in the U.S., through Orillas a Orillas, which now is part of I*EARN (http://www.iearn.org).

N'Goundo Magassa

The Lab School
Manhattan, New York, USA

N'Goundo is a high school student who played a central role in YouthCaN, a worldwide conference of students. She talks about it enthusiastically as a "kid-run and kid-friendly" event, where kids teach other kids about the environment and technology and make contacts. They share in involving students as well as helping them. N'Goundo came to the I*EARN conference to tell other students about YouthCaN to increase the global participation.

Professor Millard Clements

Department of Teaching and Learning
New York University, New York, New York, USA

As a founder of YouthCaN, Millard talked about how telecommunications is "one of the hopeful changes in a world," in which there are so many changes—some of them threatening. He has seen students take their own work seriously and want to share it with others. With access to information, students are participating in a community and forming new communities. Millard is especially proud of a project on trees started by one of his graduate students five years ago. Students are ask to write and draw about the trees in their communities. This project has numerous contributions from around the globe and is shared with everyone on the Web. http://www.nyu.edu/acf/pubs/connect/spring97/InstrClemYCanSp97.html

Petr Vrzacek

Teacher of Math and Civics
Modranska Zakladni Skola
Prague, Czech Republic

Petr has observed "big changes" in schools because of the Internet and other media. Students have shared project results and discussed their goals, learning about others who are doing the same. He felt that this is a "cheerful" and "interesting" way for them to be involved, and recommends that "we should all follow it."

Victor Minachin

Director of the Cyberlaboratory
Russian Academy of Sciences

Coordinator, I*EARN's Interregional Russia Coordinators
Moscow, Russia

Victor, a well-known Russian scientist, was asked what was the most important new technology. "The airplane," he said. He describes how 10 Russian students who participated in the Holocaust/Genocide project, traveled to Israel. These kids "learned much more out of their trip than they could from 1,000 lectures."

2. Using Students as Resources

In listening to the many hours of interviews with teachers, we were struck by how many of them discussed the strategy of using students to help increase the technical expertise of adults.

Professor Beata Brestenska

Faculty of Natural Science
School of Education
Bratislava, Slovakia

With glee, Berta tells the story about the traditional teacher who wanted to write an educational book. He asked a student to help him and the student replied he needed a computer. The teacher said, "But I don't know how to get you a computer." "Don't worry," said the student. "I'll find one." Thus, the student countered each of the teacher's obstacles. This "opened the teacher's eyes," and working together the teacher and student created an "excellent" students' book.

Istvan Szabo

Teacher of Infomatics and Humans and Environment
Berze Nagy Janos Grammar School
I*EARN Coordinator for Hungary
Gyongyos, Hungary

Istvan's students "got hooked on the Internet" and built a school network based on an already existing cable TV infrastructure in their town. All of the students were given their own e-mail addresses, and computers were set up for classroom and library use at different times. Everyone was greatly surprised at how popular the computers were. There was actually a "fight" to get in to the rooms, and this required an extension of the hours. Students "met the new technology" and introduced themselves to others, telling stories about themselves to their "pen friends," including one 11-year-old girl who had 15 keypals in South Africa alone.

Philemon Kotsoane

Headmaster, Micha-Kgasi High School
Kgabalatsane, South Africa

Philemon's school received 21 donated computers from a private girls' school in

Australia, as part of I*EARN. These computers changed the lives of students and teachers. Despite demoralization among teachers in South Africa, Philemon saw a new enthusiasm from the introduction of computers. Students use the computers during the school day, saving their work on disks, and he puts the material online at home that night. More teachers stay after hours to use the computers. And in a major new step, students received training as "computer mentors" so that they can be trainers to their fellow students as well as to the teachers. This is something that "empowered the pupils."

Violeta Tsoneva

English Teacher
German Language High School
Sofia, Bulgaria

Using technology is something new for Violeta. As a poet, she was fascinated how her role changed when she and her class went into the computer lab. "We were both in a new situation, doing something together, "partners in learning." Violeta says that computers "didn't make her life easier," but she knew "for sure they have made my life more interesting and exciting."

3. Finding Funds From the Community

Community partnerships were another strategy that characterized many of the stories we heard. We hope these ideas will help extend your thinking of how to increase the resources in your schools.

Lic. Ramon Fons Vilardell

Mayor of Callus and Professor of Catalon
Callus, Spain

Callus is a small town (pop. 1,200) in the mountains outside Barcelona, which, like most rural villages, suffers from isolation. The townspeople are trying a three-pronged approach to solving this problem. They began by opening a computer lab in the school, which had access to the Internet, and doing I*EARN projects there. The lab is open on Saturday mornings for children who don't have access to computers and the Internet at home. This year Callus is beginning a project to teach its elderly how to use computers and the Internet. At the same time, town leaders are seeking subsidies so that they can work with small businesses to use the new technologies to expand their customer base.

Bob Hofman

Teacher of Infomatics
Kruisheren Kollege
Uden, Netherlands

Bob faced the same problem most of us face—he wanted to integrate schoolwork with computers, but his school didn't have enough money in its budget for the hardware, software, and fast network connections he needed. So Bob worked out a deal with a local bank whereby the bank spent $30,000 on new information technology equipment for the school. In exchange, the bank sends its staff to the school for training at night by Bob and some of the other teachers. Next, the local bank then decided to open a business as an Internet service provider, and again, teachers and students became involved in training the local business people in creating Web sites. The bank saw this as a good investment and now understands that students, as future personnel, need technology training, and thus need the equipment. As more money comes in, says Bob, "it creates more possibilities to use information technology." http://www.telebyte.nl/~hofman/person1.htm.

Yoko Takagi

Representative
Teleclass International Japan
Osaka, Japan

One hundred schools are involved in a new international networking project in Japan: 20 elementary, 30 junior highs, 40 senior highs, and 10 special schools are connected to the Internet. Although many Japanese schools were connected, they did projects within their country. Individual teachers struggled to find partners in schools overseas because there was no national group to help them. The government, through the International Trade Ministry and the Education Ministry, has now started the Working Group for Internationalization.

Philemon Kotsoane

Headmaster
Mich-Kgasi High School
Kgaloalatsane, South Africa

In five regions of South Africa, there were regional school networks existing in isolation. In June, these networks, along with several ministries, formed a partnership with corporate and nongovernmental organization involvement: Schoolnet South Africa. The goals are to share technology, reduce prices, and, if possible, make free Internet connections or supply toll-free numbers. But, as Philemon points out, what will actually happen depends on the organizations.

4. Bypassing the Barriers

All schools faced problems, but what distinguished these educators were the creative solutions they used to bypass the barriers.

Istvan Szabo

Teacher of Infomatics and Humans and Environment
Berze Nagy Janos Grammar School
I*EARN Coordinator for Hungary

Gyongyos, Hungary

Istvan talked about the language barrier caused when most international projects are conducted in English and how the Hungarians are working around the problem. First, he encouraged his students to send messages and do projects with other Hungarian students. They when they were comfortable with the technology, he encouraged them to overcome their fear of writing in English. "I tell them to just try it," he said. "Nobody cares if your English isn't perfect."

Jacqueline Jumbe

Program Director
Entrepreneurship and Employment Training
Global Education Partnership
Wundanyi, Kenya

Computers are scarce in Kenya and few teachers know how to use them. Jackie is teaching basic computer skills such as Word and Excel, but she also is involved in using e-mail to teach cross-cultural skills to both students and youths who are no longer students. (They can't explore the Web because Internet access is too expensive in Kenya.) For Jackie, it is very important for her students to learn the cross-cultural skills because "it puts the students in a better position to accept themselves as part of the world—to see the world as a small village and not as something big that they are not able to reach."

Cornelia "Nelly" Platon

English Teacher, Learning Circles Coordinator
Alexandru Papiu Ilarian High School
Dej, Cluj County, Romania

Nelly and her students have participated in several intercultural projects with Learning Circles (http://www.iearn.org/circles) and learned much about other countries. It distressed her and her students, though, to discover that their partners in other countries thought that the Romanians "were not developed from a cultural point of view." This has given Nelly a chance to communicate what she thinks is important about contemporary life in Romania, as well as in their area of Transylvania. She points out that since the 1989 revolution, her country had participated in international projects and competitions with good results, and "we hope that [others] will change their points of view about us."

Subude

Computer Science Teacher
Beijing Bayi Middle School
Beijing, PRChina

Subude, who has no last name because she is a Mongolian, was responsible for teaching 400 students, which was a difficult situation. Last year she found corporate support and received software and free Internet access. Her computer was networked so that she could be in a classroom of 50 and they could more easily participate in global projects. "International communication is very meaningful," she believes, and wants to collaborate on projects with others.

Daniel Zappal‡

Especialidista
Computadoras para personas con discapacidad
Fundacion Evolucion—I*EARN Argentina
Buenos Aires, Argentina

Daniel works with 65 schools for the visually handicapped and blind throughout Argentina, linking them with 500 mainstream schools to exchange projects, experiences, and feelings. This effort is supported by I*EARN Argentina and the Ministry of Education. The aim of telecommunications in education is that students and teachers learn from diversity. Adding the visually handicapped to the Argentine network, which also is international, adds another kind of diversity, which in turn enables more learning for everyone.

He tells the story of a boy in Cordoba who was a soccer fanatic. Through the network, he was able to communicate by e-mail with the coach of his favorite team. When this team came to play in Cordoba, the boy was invited to visit them in their hotel and ride with them to the stadium. "He changed completely," from this experience, going from "being shy and not outstanding in any way to becoming one of the pillars of telematics in his school."

5. Students Making a Difference

In this final story, you hear about how the students in the second poorest region of the second poorest state organized their whole Zuni community to help their network partners on the other side of the globe. It is a story of people sharing their human warmth.

Siriluck Hiri-O-Tappa

Teacher of Thai Culture
International School
Bangkok, Thailand

Siriluck wanted to get Karen hill tribe children in a mountainous border area in Thailand, neglected by the government, involved in the Indigenous Global Art Project. She wanted to give the children an opportunity to learn about other indigenous people around the world and, by sharing art projects, to feel good about themselves. Siriluck traveled more than 12 hours by van and four-wheel drive vehicles to reach the mountain village. Once there, she encouraged the students to "draw and talk about themselves in an art form. " She also made a videotape of their lives to send with the art and stories to schools in Australia and the United States.

The students who watched the video were "surprised to see the conditions of the Karen people" and they wanted to help them. Zuni children in New Mexico drew blankets on greeting cards and sold the card to raise money. The village had a special exercise day, donating the money from this event. The students in Australia had a festival, and the result was that $1,800 (U.S.) dollars was sent to Siriluck for the indigenous Karen children. She returned to the Thai mountains with a power generator, blankets, and other dorm supplies that were needed because the children come from rural areas to live at the school while they attend it. One of the Karen teachers said that he can't believe that "people who have never seen these people care about them."

General Session: Curriculum Design/Strategies

AccuNet/AP Photo Library: Internet Access to Associate Press Photographs

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Key Words: Internet, photographs, teachers, librarians, current, historical, archive

Access the Great Photo Library of the Associated Press

Today children have instant access to information, but parents and teachers are not always sure that this information is valuable and worthwhile.

There is no doubt about the value of the AccuNet/AP Photo Archive. Available now to schools K–12, public libraries, and colleges across the country, this new, invaluable resource provides students with instant Internet access to the award-winning photo collection of the Associated Press, a collection of 500,000 current and historical photographs. The Archive is constantly growing as more than 800 photos are added each day. It is a unique educational resource.

Photographs of current events are available within minutes of the event occurring anywhere in the world. Historical photos of the great leaders and events of the last hundred years appear within moments. All photos come with full descriptive and informative captions, and can be printed out on any standard printer.

In a recent pilot study carried out in middle and senior high schools, every teacher and librarian surveyed recommended the purchase of the AccuNet/AP Photo Archive. Students quickly learned to use the Archive as an essential resource for research projects, term papers, reports, or just for fun. Teachers turned the photographs into slides and overheads for classroom presentation. Librarians no longer had to undertake long searches or maintain hard-copy picture files, and are reporting that vandalism of library resources is greatly diminished.

Until recently, the Archive was available only to media organizations and corporations at a premium cost per image. With a subscription to the AccuNet/AP Photo Archive, schools, public libraries, and colleges can access this magnificent store of information for a fraction of the cost.

A free demonstration of the AccuNet/AP Photo Archive is available at http://ap.accuweather.com

Workshop

Art and Technology ... Not an Oxymoron

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Key Words: art, Photoshop, digital imaging, art integration, image manipulation

Patricia Rucker, an art teacher at Summit Ridge Middle School, and Terry Wallace, math and technologist at Carmody Middle School in the Jefferson County School District of Lakewood, Colorado, are implementing their district's Visual Art Content Standards:

- Communication—students recognize and use the visual arts as a language for communication.
- Perception—students know, understand, and apply basic components of the visual arts as they solve visual problems.
- Application—students know, understand, and apply materials, techniques, processes, and technology related to the visual arts.
- Heritage—students relate the visual arts to historical, cultural, and personal heritage.
- Aesthetics—students analyze, interpret, and evaluate the characteristics, merits, and meaning of works of art.
- Transfer of Knowledge—students know, understand, and apply connections between the visual arts and other disciplines.

In implementing these standards Patricia is extending the traditional art program by incorporating technology. Terry is providing art experiences in a technology setting. Both curriculums are designed to expose students to potential real-world uses. Working together and individually, these teachers have developed an array of projects and skill-building activities incorporating art and technology.

This workshop will explore projects and activities through a variety of image-making experiences. Beginning with simple assignments that use the elements of art and the principles of design, participants will practice skills using the tools of the software programs and then create their own images. These images will then be manipulated using the unique power of technology. A follow-up to each activity will include a discussion of extending the experience, a presentation of student work, and a brainstorming session of how these designs might be further enhanced using traditional art media.

During the second activity participants will explore the differences between paint (rasterized images) and draw (vector-based) programs. Again, follow-up will include discussions, presentations, and brainstorming of how the works created might be further developed using both traditional and nontraditional media.

The third activity will cover how images are captured and manipulated. This will include layering, transformation, distortions, filters, color enhancement, and other plug-ins. Images will be captured using a variety of input devices, such as a digital camera, scanners, and a camcorder. Again, discussion will follow with participants brainstorming how they will begin implementing art and technology.

Throughout this presentation, a variety of software will be demonstrated and utilized by the participants. We assess the powers and limitations of the software packages and their appropriateness and cost in a variety of situations.

General Session: Emerging Technologies

Build Your Intranet With Web-Enabled Databases

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Key Words: intranet, Internet, Web, K–12, schools, teachers, administrators

Why create an intranet? It allows students, teachers, and administrators to collaborate, find and share information, and enable a streamlined workflow. An intranet is an internal school network that uses Internet-protocols, a Web server or servers as centralized information storage, and Web browsers as clients. Most desktop educational environments now have browsers available. Browsers are easier to manage than having multiple programs on these client machines. Staff development issues can relate more to the curriculum and less to specific software features. Intranets allow quick, easy access to critical information.

Parts of the intranet can be Internet-enabled (an "Extranet"). Parents or community members may want to access public documents or calendars.

An intranet must be more than just a collection of Web pages with static information. It should be a gateway to significant, real-time data with a simple user interface.

There are many product solutions that claim to be able to create intranets "on the fly."

We found that these one-stop solutions don't take into account the legacy information that exists in various forms in the school's administrative and instructional areas. Attendance can be on one computer system and grades on another, while medical, travel, and employment forms may be archived in the old-fashioned "dead trees" format. Every school is a unique situation. We initially created an intranet for our own site and developed reusable modules so that other databases and forms could be Web-enabled, as they became available. We accomplished this with both simple and complex databases.

We then built a number of Web-enabled solutions for K–12 schools, including a technology activities database (TAD) built upon and linked to the New York State Standards, a curriculum-mapping database, and a collection of databases that are linked together in an intranet for the administration of a large school district.

The following are some of the questions we asked teachers and administrators before the development cycle:

- What application/data do you access most frequently? (attendance, grades, school and district address book, telephone, e-mail addresses)
- What forms do you fill out often? (attendance, grades, human resources, conference and courses)
- What documents and information do you share frequently with others and how do you access this information at the present time? (lessons, customized curriculum and content maps, staff development classes)
- What documents and/or information should be available for secure access by parents/guardians?
- What documents and/or information should be available for the community and general public?

We will share some of the technical issues we had to address:

- What would be the best Web-server platform?
- What type of standard database platform would be useful?
- What method is best for Web-enabling of databases?
- How can users with different Web browsers be able to use the intranet?
- What programs should be used to create the environment?
- What type of databases should be supported?
- Who will do all this work?

Intranets can be developed on Web servers for all computer platforms.

Our development took place primarily on the Windows NT 4.0 platform using the Internet Information Server (IIS 2.0) as the Web server platform. The hardware and software consisted of:

Dell 4200 Single Processor Intel Pentium 255 MHz
256 Meg RAM
8 Gig Raid Array
Web Database Connector: WebObjects for NT by Apple/Next
IBM PC 700 Dual Processor Intel Pentium 200 MHz
128 Meg
8 Gig Raid Array
Domino/Lotus Notes Server version 4.6
5-Client Lotus Notes Users
Compaq Deskpro Intel Pentium 133 MHz
64 Meg Ram
2 Gig Hard Drive
NT Server 4.0 Test Machine

Workshop

Geometry and the World Wide Web: A Feast for the Senses

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Key Words: geometry, Internet, mathematics, interactive, discovery

Technology, when used creatively and thoughtfully, can change the way we teach mathematics and the way our students learn. Interactive software can make students active learners and allow them to discover the theorems of geometry, technology can provide opportunities for students to explore and express their creativity, and the Internet can connect them to applications of mathematics, current research, and the history of mathematics.

Discovery: Interactive geometry software allows students to experiment with geometric figures and discover their properties, in much the same way that they would experiment in a science lab. I teach geometry using a discovery approach, with my students as active participants in their own learning. Using this interactive software allows my students opportunities to explore, to make conjectures, to test and verify their conjectures as they learn the theorems of geometry.

Creativity: My students construct geometric designs using the Geometer's Sketchpad software. Combining Euclidean constructions with transformations, they have created some fascinating, complex, and truly beautiful geometric graphics projects. They particularly enjoy this connection with art, design, and creativity. Another geometric construction project exploring the connection between art and geometry is my students' work with parallel lines in creating a type of art called "op art" (optical). Our study of the connections between geometry and the visual arts extends into architecture. I find that teaching my students to draw three-dimensional figures helps them develop a visual sense and a more complete understanding of parallel and perpendicular planes, volume and surface area, and non-Euclidean geometries.

Internet connections: The Internet can provide a tremendous variety of fascinating and vital information, ideas, and connections that can be used to dramatically change the way we teach and the way our students learn. The Internet can open students' eyes to the real work of mathematicians.

I am currently teaching an "E-school" geometry class over the Internet. The address for the Geometry Web site is http://www.k12.hi.us/~csanders/.

E-school (or "Electronic School") is a distance learning project funded by a grant through the Hawaii Department of Education. Through the vast resources of the

Internet, my high school students and my E-school geometry students discover the fascinating history of mathematics and the absorbing projects that other mathematicians and scientists have created over the centuries and are actively involved with throughout the world today. My goal is to connect my students to the mathematical applications that can be found in virtually every aspect of our modern society.

General Session: Curriculum Design/Strategies

JEFF TECH: Integration + Inclusion + Technology = Achievement

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Key Words: inclusion, special education

Educators and policy makers nationwide recognize the critical need for all students to learn to think, to understand concepts, to apply what they learn, and to be able to pose questions and solve problems. Students who spend most of their time in classrooms learning one-word answers to simple questions are not likely to develop their reasoning and analytical powers.

Jefferson School, through the establishment of the JEFF TECH program, has adopted the philosophy that recognizes the need for change in the classrooms of America and has taken steps to achieve higher level learning for all of our students. First, the curriculum has been restructured to include thematic units that integrate science, mathematics, social studies, language arts, and the fine arts. Second, students in all classrooms, including those who are gifted and who have special needs, have become active learners in constructing their own understanding. This learning occurs through interactive support in which teachers work not as fact tellers but as coaches and facilitators. Third, multimedia technologies have been incorporated into the curriculum. These technologies have significant potential for supporting an integrated curriculum and active student learning.

Student work groups concentrate on projects that incorporate all of the areas of study. They utilize the technology available to them to research topics and compile data and text to design their presentations. Students use technology to teleconference and videoconference with other schools and with experts in the area of their research.

Jefferson School practices inclusion of all students through the Regular Education Initiative (REI) model. Students of all ability levels work together. Classroom teachers collaborate and team teach with specialists in the areas of speech pathology, gifted, reading, and special education. Great attention is given to addressing the individual student's learning style.

General Session: Technology Training/Staff Development

TAPPED IN: A Testbed for New Models of Online Teacher Professional Development

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Key Words: professional development, online activities

SRI's Center for Technology in Learning is working in partnership with several nationally recognized education organizations, educational Web site hosts, preservice programs, and local education agencies to jointly establish a sustainable online teacher professional development (TPD) community called TAPPED IN (short for Teacher Professional Development Institute, see http://www.tappedin.org). Our goal is to begin supporting teachers during their preservice education and continue to serve them as they become leaders in their professional community. We envision a year-round TPD process that strikes a balance between formal TPD efforts and the kinds of informal professional activities that are characteristic of other professional communities of practice. As described by Judith Renyi (1996; http://www.nfie.org/takechar.htm), professionals in most fields routinely network with fellow practitioners, conduct and review research, and talk to experts and colleagues about new trends, thorny issues, and plans for improvement. These opportunities for professional growth and renewal often take place within the workplace and are integrated into the daily life of the practitioner. Teachers should work collaboratively; yet all day they are isolated from other adults.

Although we cannot change school policies or find more time for teachers, we can help provide opportunities and mechanisms for teachers to overcome their isolation and make more effective use of the time they spend on their own professional growth. Our platform-independent, Web-based, online environment is designed specifically to meet the needs of a large and diverse community of education professionals. On any given day, TAPPED IN members can attend activities hosted by partner organizations, conduct their own activities, or expand their circle of colleagues by participating in real-time or bulletin-board discussion groups. We and our partners provide the tools, resources, and social support structures needed to supplement face-to-face events and sustain the kinds of interactions that are characteristic of successful collaborative work.

We invite organizations representing divergent perspectives and approaches to employ the TAPPED IN environment to help accomplish their own TPD agendas. In this way, online tools and practices become part of their institutional culture rather than tangential add-ons. By sharing TAPPED IN, the organizations enable their affiliated teachers to gain access to expertise, ideas, and resources that no single organization could provide by itself. Educators who are not affiliated with a partner organization can also participate in, help shape, and take ownership of the community. SRI's multiple role as environment architect, community organizer, and support provider enables us to embed our research within a rich mosaic of authentic, ongoing teacher professional development efforts with the full participation of the practitioner community.

We currently support a community of more than 1,000 members. With SRI staff and community elders serving as Sherpas, teachers discover for themselves how online activities can support their professional growth. We discuss the lessons we have learned and how the community has helped us reconceptualize and expand our initial vision of an educational professional community of practice.

General Session: Technology Training/Staff Development

Effective Search Strategies: How to Find It on the Net

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Key Words: searching, evaluation, Schrock, search, engines, directories

Short Description

Discover how with a few tips and tricks you can easily find the information you are seeking on the Internet. Learn how to choose the best search tool for your purpose, and investigate some of the advanced search strategies.

Summary

One of the common complaints that users have with the Internet is the inability to find the information they are searching for. This is no surprise, given the huge amount of information on the Internet. However, there are certain search strategies that can be employed to help assure that the searches prove a bit more fruitful.

The participants at this session will come away with the knowledge needed to effectively use the search engines and directories on the Internet to locate the information that both they and their students are looking for.

This presentation will start with an explanation of the difference between search engines and directories, concentrating on the fact that directories are put together by humans and search engine databases are created by software "spiders." This is often an area of great confusion to Internet users.

The participants will learn how to improve their use of search engines. Strategies covered will include Boolean and wildcard search methodologies. Three of the major search engines will be investigated and the same advanced search will be conducted in each engine to demonstrate the differing results of the searches.

The presenter will provide examples of certain types of information and explain which search engine is the best to use for finding each type of information. This will be followed by a list of ways to help students learn to search and evaluate, and a look into the future of searching will conclude the session.

URLs of the pages used for information for the slide show:

http://www.etc.bc.ca/tdebhome/searching_faqs.html
http://www.sci.ouc.bc.ca/libr/connect96/serach.htm
http://www.teleport.com/~janetm/
http://www.nueva.pvt.k12.ca.us/~debbie/library/research/adviceengine.html
http://www.zdnet.com/pcmag/features/websearch/sb1.htm

General Session: Special Needs

Promises Unfulfilled: Computers and Gifted Students

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Key Words: gifted students, talent

A major reason for this topic is that relatively little research in the area of giftedness and talent has addressed computers and learning. Conventional wisdom indicates that computers and gifted children are a natural combination, yet a search for studies in this area produced few research papers, none of which addressed the questions in this study. Further, researchers have not looked at children who, with experience on home computers, have achieved a high level of expertise in computer applications and/or computer programming outside the classroom.

The intellectual characteristics of gifted children suggest that those who are interested in computers are enabled to achieve a high-level of proficiency with either computer applications or programming. However, no published evidence has been found to support this thesis. The ability to learn things at a young age should allow gifted children who use computers to develop a large variety of computer-based activities. Again, there is no published evidence found for this contention. Finally, facility with computers should allow these children to create new activities for using computers, but no published research was found to demonstrate whether they do. This study consisted of a questionnaire requesting usage data on seven different computer uses. The data described basic, though not detailed, characteristics of computer-using gifted children. These data do not describe all gifted children, nor all gifted children who are interested in computers. The sample was neither scientific nor typical, nor was it intended to be; these children were all self-selected. The study led to several conjectures about the interactions of gifted children and computers.

There is evidence in the study that schools do not well serve gifted children regarding computer use. As a result, here is evidence many gifted children learn what they know about computers and computer applications at home or elsewhere. Further evidence indicates that, without formal instruction in school, these children have constructed their own ideas of what computers are for and what they are able to do with them. Though many of these uses are no different from the ones that other children and adults have found for computers, the study found some idiosyncratic uses and meanings.

This project is not now, nor will it be a commercial product or venture, though it does make use of a software product that is on the market. The Education Program is an educational outreach program of the Lawrence Livermore National Laboratory. The Laboratory is managed by the University of California, under contract to the

United States Department of Energy.

National Educational Computing Conference 1998, San Diego, CA

Workshop

Beyond Web Pages: The FrontPage Web Site

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Key Words: FrontPage Editor, Web pages

Instructional materials available online at
http://www.a-plus.net/education/frontpage/

You do not need to know HTML to use the FrontPage Editor because it creates all the HTML code for you. The FrontPage Editor generates all the popular HTML tags and lets you incorporate popular new HTML extensions, such as frames, ActiveX Controls, and Java applets. Although it is very powerful, the FrontPage Editor is easy to use and has a familiar, word-processor interface. The real challenge is creating a good Web.

- Editing and working with FrontPage is easy.
- Creating a good Web site is not!
- It takes planning!
- What do you want to accomplish?
- How to organize the content?
- Who is the audience for the site?
- What are the topics and areas of focus?
- What features do you include in your pages?

General Session: Curriculum Design/Strategies

Applied Learning Projects in the Vocational Education Classroom

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Key Words: applied learning, problem solving

What is Applied Learning?

Asks students to learn curriculum content and to use what they learn in solving a problem or fulfilling some important need.

Leads to a solution (e.g., a product, a service, an event) that:

- addresses an audience(s), other than the teacher, who is /are likely to use, benefit from, or base a decision on the solution
- cannot be completely specified in advance
- is comparable to a solution in the adult world
- has consequences beyond students' simply receiving a grade or demonstrating that they know a particular subject

Requires students to communicate:

- in different circumstances
- in a variety of media
- with a variety of technologies

Requires teacher and students to share responsibility for:

- defining the problem or need the project will address
- figuring out the best way(s) to solve the problem or address the need
- finding resources beyond the textbook or encyclopedia (including project $)
- continually monitoring and assessing students' work
- developing assessment criteria that are consistent with the goals of the school district's curriculum and based on competent adult models

Involves students in tasks that are increasingly demanding and complex

Learning Environment of the Applied Learning Classroom

The applied-learning classroom is a vital, energetic place. Students are interacting constantly with one another about their part in the class project. (It has been compared to an ant hill or beehive!) Applied learning is for students who want more out of school than just to pass or graduate.

The teacher's role has changed from being in total control to becoming a facilitator.

Educational environment has changed from teacher-driven mechanism to:

- student-driven mechanism
- student-goal oriented
- foster democracy
- subjects are no longer isolated
- a positive environment
- ongoing assessment
- self-assessment has more value because students have more input, more participation
- rationale is easier for students to understand
- students are more than open vessels to fill
- lot of teacher planning (overall goals) and classroom organization needed, especially in the beginning
- the classroom becomes part of a larger community

Applied Learning Project Characteristics

All applied learning projects follow a predictable format:

- They stem from a competent performance.
- The product produced by the project (or performance culminating the project) will demonstrate absolutely that the student has anticipated the needs and values of a specified audience.
- Projects are all consistent with district curriculum goals.
- Projects anticipate the need for resources.
- Project contain a sequence of events precisely and thoroughly laid out.
- Projects contain defensible pre- and posttests.
- Projects include a rubric (scoring criteria) for the culminating product/performance.

Workshop

The Internet: It's Far More Than an Encyclopedia, Mr. President!

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Key Words: Internet, censorship, infusion, multiple learning styles, real-time learning, student mentoring, e-mail, projects

The exploding influence of the Internet is happening, independent of conventional, educational models. Current research suggests that because of the inevitability of the growing number of schools going online, teacher/student roles will shift, classroom walls will fall—the global schoolhouse is rapidly becoming a reality. The inescapable ramification is that the teacher will no longer be the sole source of knowledge but rather manager, guide, facilitator, mentor, goal keeper, and shared learner. The student will no longer be the passive learner, but rather mentor, shared learner, and responsible partner. This is a frightening concept to many teachers and administrators. This is an enlightening concept to us. Given our four years experience infusing the Internet into our classrooms, we believe it to be the most empowering, exciting tool we have ever encountered and are convinced that it is revolutionizing education.

In his 1997 inaugural address, President Clinton became the first president ever to mention the Internet. Ten years ago the Internet was the mystical province of physicists; today it is the commonplace encyclopedia for millions of school children.

We disagree! In our experience infusing the Internet into the classroom, we have learned that it far surpasses an encyclopedia.

We have discovered the Internet is living, breathing, and current, and it provides innumerable hyperlinks to infinite ideas and opinions. This phenomenal tool stimulates higher level thinking and invites discovery, pride, and excitement in the students if used correctly!

During the course of our workshop participants learn to infuse, not just use the Internet, and therefore use the power of this tool to transform education.

Salient features of the workshop include a review of key surfing skills, based on individual needs; participation in Internet group projects, which illustrate the power of the tool; and an in-depth discussion of the related issues—censorship, validity, teacher training, e-mail, teacher rejuvenation, student mentoring, intercurricula projects, teacher as facilitator/student/shared learner. The positive impact the Internet has on all types of students, including disaffected and handicapped, is stressed.

The ultimate goal is to prove that the Internet is much more than a reference tool. It is an invitation to interact with the world, that is, professors, experts, scientists, writers, politicians. It is an opportunity for students to become responsible for and excited about their own learning. Participants leave this workshop with a keen awareness of the crucial impact of this powerful tool and the impending revolution in education.

Paper Session

Students as Mentors of Technology

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Key Words: videoconferencing

Introduction: Videoconferencing—Collaboration in Failure

We are a group of five self-selected online doctoral students at the California Institute of Integral Studies (CIIS) who've embraced videoconferencing as a method of inquiry. We call ourselves the New Technology Group (NTG). As of this writing we are in the third quarter of working as a collaborative action inquiry group. Our mutually negotiated goal, the focus of our inquiry, is to contribute to the formal knowledge base of adult online learning, the impact and possible benefits of more advanced computer-based technologies through student-mentored technology enhancements.

The NTG is studying how various modes of online communication (synchronous and asynchronous, videoconferencing, and chat groups) impact our experience, styles of communication, and need for skills as students in the online medium. We've expanded the study to include phenomenological interviews with graduate students using the online mode of education from other institutions. We are hoping to include an inquiry into aspects of mentoring in an online environment. We are examining this from a systems perspective, based primarily on the work of Wheatley and Kellner-Rogers in "A Simpler Way."

Student Mentors

Students involved in the inquiry live respectively in Northern and Southern California, Virginia, New York, and Washington. Acting as technology mentors and scholars, we charted our progress as well as planned our next steps through a series of preset action-reflection cycles. These preset cycles allowed for continuous academic assessment of our efforts. Instructors were able, at any time to check on compliance with program standards. From the outset of the inquiry, both enthusiasm and responsibility were guaranteed from each member of the team as a result of the collaborative goal-setting and implementation of the team-chosen research design and structure.

Action-Reflection Cycles

The action-reflection cycles allowed us to convene at preset times to check in with each other, reporting our progress as well as our set-backs. The action-reflection cycles served to keep us on task as well as keeping all members of the team in constant communication. As we evaluated our progress, we were then able to agree and define what activities were necessary for the next action cycle. Most often, the joy of discovery, even discovering what was not working, was prevalent and served as the guide to form our next steps. Thus the beginning of embracing failure. As activities were carried out, the study group attempted to convene in videoconferences, but not all members were able to participate each time. However, each member of the NTG reflected on the experience. Detailed notes on the attempts, the success/failure, and the steps taken to ensure future success were circulated.

Obtaining Instructor Feedback

We carried our research cycles out in a "fish bowl" conference online. The CIIS uses the Meta Network system for online classrooms. Unlike e-mail-based classes, anyone with a password can "check in" to items and read the postings. At any time the instructor could view the inquiry as it was progressing, choosing to interact, ask questions, or add suggestions. Other students who were not part of this inquiry team were also allowed access to observe our process as well as to ask questions or add suggestions. As we continue in this environment, we see the possibility and hope to implement a mentoring component as part of our inquiry. As new cohorts are started at CIIS, students will develop and support newer students in the methods and process of implementing new technology within the online environment.

Systems Application

In the opening to "A Simpler Way," Wheatley and Kellner-Rogers begin with "an invitation" in which they outline the basic tenets of their thinking about systems:

- "The universe is a living, creative, experimenting experience of discovering

what's possible at all levels of scale, from microbe to cosmos."
- "Life organizes around a self. Organizing is always an act of creating an identity."
- "Organizations are living systems. They too are intelligent, creative, adaptive, self-organizing, meaning-seeking."

These are the traits that inform our idea of NTG as an emergent system that is self-organizing. In our study, we watch ourselves in the process of discovering new skills and ways of communicating to see what develops and what systems emerge.

The concepts of emergence and self-organization are very evident in NTG. As we've struggled with the technology, leadership shifts, new or modified ideas emerge, and the group organizes fluidly in response. The dynamic is both internal (influenced by systemic dynamics, feedback, dynamic equilibrium, communication) and external (contextual, as relating to the environment and larger system most evident with the technology).

"Life Self-Organizes"

We are experiencing new dynamics as we explore different methods of connection. Chat technology changes the speed and energy of decision making online. Seeing a person's face on your screen causes a very visceral reaction and response. Here are some quotes from NTG members describing their experiences:

- "Also it felt like our 20-minute conversation was more productive than several weeks worth of online asynchronous decision making."
- "I felt an incredible surge of energy today when we chatted. After a year of asynchronous, or unintentionally synchronous, online communication, the fact that four of us were, at the same time, connected together for the purpose of talking was an amazing alignment for me. To me, the shared intention was tangible. It felt that our energy actually began to flow and move in a direction. It felt less chaotic, to a certain degree. And boy, was it easier to make decisions!"
- "When we are chatting it is a more personal experience, and I am more effortlessly willing to take on whatever tasks are necessary. Whereas online, I wait until others have seen postings and have a chance to respond or pick up the ball and make a decision before I move on anything. The online asynchronous mode really allows for a certain impersonalness and lack of responsibility."
- "Finding a rhythm in the chat room does take a bit of time. What I finally wound up doing was typing a response and then waiting to see if anyone else said something first so that I wouldn't splinter the conversation yet again."
- "The frustration of missing what you know to be going on is incredible as is the panic to get on as fast as possible. Once the real-time chats are done, they're done. Obviously this isn't like the asynchronous world in which you can do things in your own time. All of a sudden we're dealing with real time, and it seems speeded up somehow...."
- "I would never ramble on like this in a chat. The style there is succinct and to the point, without much explanation. Then if someone asks a question, you

can clarify. I find that in asynch, I tend to try and foresee the questions and address them in the original posting."

- "Cognitively: you cannot post long items, no 'cut and paste' (you can only save a small portion of the transcript at a time), the long thinking that comes from integration and weaving doesn't seem suitable for chat. Behaviorally: you have to rearrange your schedule, it is like being back in class. For me I have given this up, so it is hard to start again. Affectively: it is really, really fun!"
- "I concur that typing speed counts. In tonight's videoconference, it took quite a bit of time to get a rhythm for posting and maintaining the flow of the conversation. I will be glad when I figure out audio."

Technical Angst—Failure 101

Some or all members of the group experience technical difficulties at different times while working with the new videoconferencing technology. The complexity of fitting the various pieces of software, hardware, netware, and telephone technology in ways that match is outside the control of any one member of the group. It is a true collaboration.

We've discovered many ways that videoconferencing doesn't work. We are learning from each one of these failures. To succeed, no doubt we will fail many more times. We have related this to the paradox of "failing to learn" and have placed our faith in Wheatley's assertion that, "Life uses messes to get to well-ordered solutions. Life doesn't seem to share our desires for efficiency or neatness. It uses redundancy, fuzziness, dense webs of relationships, and unending trials and errors to find what works" (p. 13). As we continue to spread the breadth of the community by welcoming new participants to the project, we will continue to emerge in our focus and goals, to include and reflect the experiences of those joining.

Application to Online Learning

In seeking to expand this work into the larger systems in which the NTG is embedded, we look again to Wheatley's concepts of systems and how they develop. In describing the development of community-organizing efforts she writes, "People work on a small effort and discover new skills. Their energy and belief in themselves grow; they take on another project, then another. Looking back, they see that they have created a larger system whose capacities were undreamed of when they first began" (p. 70).

Videoconferencing Equipment

Desktop videoconferencing was accomplished using both PCs and Macintosh computers, transmitting over POTS (plain old telephone lines). The purpose was to test the limits of what low-end desktop units could offer in a doctoral program. Each participant selected a camera, given hardware and financial resources. Selections ranged from the high-end U.S. Robotics focusable camera to the stand-alone Connectix desktop unit.

The Global Schoolhouse was used as the reflector site for videoconferencing. IP address 199.106.67.100. During the first six months of this study, the Global Schoolhouse experienced a reflector fire. This produced one of many set backs. White Pine Software has continued to upgrade and update the CU-SeeMe software. Updates to the Macintosh version to 3.1 were another factor in impeding a full connection with all conference members.

At the conclusion of the initial study period, all participants agreed that the arrangement was at least satisfactory. Because videoconferencing is expected to remain an adjunct to the asynchronous learning environment, this hardware set up is satisfactory.

Collaboration In Failure

In assessing our work in videoconferencing as a tool for education and mentoring, we've been forced to realize the prevalence of failure. We've been confronted with the need to accept a few realities:

1. The technology is unreliable.
2. No matter how intelligent we are, many of the dynamics and situations we face are out of our control.
3. Once an asynchronous pattern of interaction in an online classroom is established it is difficult to re-engage in a synchronous mode.
4. Even with fully operational equipment, the variances in Internet traffic may impede a conference from being completed.

Because of these realities, we've determined that failure is "grist for the mill" in working with videoconferencing projects in education. We are defining failure as not meeting clear, measurable outcomes in successfully implementing and connecting using videoconferencing on the Web. However, we are not defining the project as a failure. We've enjoyed great success in our failure!

Let's examine the two realities of videoconferencing we've confronted:

First, that the technology is unreliable. In spite of (or maybe because of) the Intel/Microsoft dominance of personal computing, the technology is no where near the level of reliability of television or other older technologies. Personal computing is still an intimidating, confusing adventure for most adults.

For children growing up with computers, it is less of a challenge. Yet, it is still common for software and hardware to fail for unknown reasons, for crashes to occur in the midst of crucial work, for programs to fail to load properly even though one is following the directions perfectly. In other words, there is still a sense of adventure and uneasiness when stepping into the computing arena. The outcome is not assured.

In addition, there is a whole new, arcane language to master to navigate in the computing arena. Some of the language has become part of the lexicon, even though the exact meanings of some of the usage is unclear. "Boot up," "packet," "codex," "grayscale," "frame-rate," "IP address," and more are part of the everyday language of the "nerd." Those of us less technically "hip" may have difficulty understanding the technical meaning of these phrases.

The second issue is somewhat related. That is the issue of dynamics that are out of our control. Even though the technology, at the personal level, is unreliable the bigger picture is even more out of control. The bandwidth problem of access to the Internet means that those trying to use equipment that funnels through personal modems are at the mercy of Internet traffic. With dial-up ISPs able to give service at speeds limited to the modem capabilities, many times the bandwidth required for videoconferencing is just not available.

So, many times our group was able to connect or meet at a reflector site, only to lose a member or two to fluctuations in the bandwidth. The issue of compatibility played itself out here, also. Macintosh computer users have different software and hardware standards than PC users, who have different choices for software and hardware. These standards are not compatible. We had no way of knowing, until we tried, if we could connect to a site that gave us the ability to conference. We had no way of knowing which sites allowed which standards until we tried them. Successful connections become more of a hope than a probability.

Given these realities, it is hard to plan for outcomes that can be readily assessed. Enthusiastic failure is the only sure outcome. Therefore, we concentrated very much on the skill-building aspects of collaboration. Using the foundation of emerging living systems as proposed by Wheatley, we embraced the "messy" nature of the technology and concentrated on being aware of different styles and methods of leadership; different styles and methods of collaboration; different styles and methods of team-building; and different styles and methods of reflecting back to the system the individual needs and learning.

Conclusion

Collaboration in failure became the rallying cry for our research group. Because no one could predict how or when the technology would fail (only that it would—often), it was a surprise and a delight when we were able to connect.

Future Implications

In designing and mentoring videoconferencing projects in education, failure must be part of the planning and learning. How do we deal with failure? How do we maintain teamwork when one or more of us is unable to master the technology? How do we function as a group when the dynamics make it easy to fail?

Our ongoing work together is focused more and more on this dynamic of collaboration and failure than it is on the technology. We are not at a place where the hardware or software are reliable enough to base a project solely on technical skills. Our belief is that the learning is greater with the "failure" as part of the process.

Mentoring will play a crucial role in building educational opportunities around videoconferencing. Because of the frustrating nature of the technology, having a guide to help "frame" the learning around failure is imperative. A collaborative approach works best for this reason.

And embracing failure a must.

General Session: Curriculum Design/Strategies

Clay Animation Using HyperStudio: A Really, Really Multidisciplinary Idea

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Key Words: animation, HyperStudio, multidisciplinary, clay animation

HyperStudio, a QuickCam, clay, and some imagination are all you need for great multidisciplinary projects! This session will show some of my results and work done by students as young as nine years old.

I had done traditional clay animation (using a Super-8 movie camera) with my elementary students in my first art room. This was way back when Will Vinton's "Closed Mondays" and "Dancing Raisins" first appeared on the scene. I kept trying to figure out a way to do clay animation using a video camera so the students could get instant feedback of their work. I never did figure out a way to use the video camera for this technique. Years passed. Wallace & Gromit arrived. I wanted to do more clay animation—but didn't want to dig out the Super-8. In a late-night aha! moment, I wondered if I could use my computer. I started thinking that there had to be a way to do this using HyperStudio.

My first attempts were with a videocamcorder hooked into my Mac Performa 6220CD. This Mac model has video in—so attaching the camcorder was very easy. It is also easy on a PC with video in. But É I knew that the computers I used in the schools did not have video in and felt I was back where I started. I wanted the students to be able to try this, too

Then, in another late-night aha! moment, I wondered if the Connectix QuickCam could be used with HyperStudio for clay animation.

This technique will work with both Macs and PCs! The following hints will help you get started and avoid some of the problems I've encountered.

You'll need:

- A computer (Mac or PC) with a way to get your images onto the computer. QuickCam by Connectix works great, and you don't need a video card or special port. An A-V Mac or multimedia PC allows you to connect a camcorder directly into the computer. You can also use a digital camera.
- Plastelene for clay animation. This is the oily, nonhardening kind of clay. My favorite is Plastalina by Van Aken International. You can get it in a great assortment of colors through School Speciality catalog (1.800.628.8608—they have sites all over the U.S., ask them for the site closest to you) for about

$3/lb.

- Stuff. You may have some ideas for characters and props É but the best way to motivate your students is to have an assortment of "stuff" available for inspiration. Let the students pick through items like old wheels from a toy car, beads, old jewelry, hardware, doll furniture and parts, string and wire, and so on. Ask them to add to the collection!
- Lights and a place to work É maybe a tripod. The Color QuickCam needs a lot of light! Be sure to get some of the old photo lights (I got mine for $1 each in one of those Dollar Stores) or desk lamps. Angle the lights to reduce shadows. The QuickCam can also attach to a regular camera tripod. This makes it easier to get the camera steady and in the right position. You'll also need room to work. And remember that the clay is oily so it will leave an oil stain. A plain background works best.

(Note: This material is © 1998 Nancy Smith. This information will be included in a new book about HyperStudio Animation Ideas. This technique was first demonstrated at "HyperFest '97" in San Diego, California.)

I am still experimenting with the process. Each try gets better! Let me know about your animation adventures! (e-mail: auntgoodie@aol.com)

Poster Session

What! No Books!

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Key Words: integrating technology in the classroom

I began teaching when only typewriters were available for teachers, 1973. And razor blades were a standard part of teachers' requests, to correct ditto sheets so copies could be made by turning the lever on the copy machine. Computers were unheard of in those days.

In the '80s I saw an Apple in the teacher's lounge. I became curious. Trial and error was the best way for me to learn how to use this gadget, so I began creating a vocabulary lesson. Very few people knew anything about the little device that sat alone most of the time, so there was not much help in learning about the computer.

I moved to a new school in the late '80s, and there was a whole room of Apple IIgs's. The students and I went to the lab as often as possible. They could word process their prose while I sat by the smartest kid in the class and constantly asked questions about how to use the computer. I learned more than the students did that year.

Then the '90s began, and I moved to a brand new, state-of-the-art, high school. It had a Macintosh LC III computer lab for all 80 teachers to bring students to. But best of all, the school was wired for the Internet in every room. I knew there was something fun to experience in this world of technology. Eventually, computers were incorporated into most of my lessons.

Many accomplishments have been made because the computer was integrated into the classroom. The students have won recognition from their projects using technology, including a S.T.A.R. award with Classroom Connect. I have been asked to present at many technology conferences. I am now a technology trainer for the state of New Mexico and an English and computer teacher. Computers have changed my way of teaching and the students' ways of learning.

The summer of 1997 happened, and a dream came true. I was asked to teach the summer school English class. We had access to a computer lab all of the time. The computers became our research mode, text book, writing tablet, note pad, and presenter. The vocabulary lists were made on the spreadsheet, Julius Caesar was read from the Internet, short story authors were researched from the World Wide Web, essays were composed and illustrated, and ideas were explored. Each student had her or his own computer and took great pride in ownership.

The use of the computer as the sole resource material in a classroom will be discussed during the session. Students' projects created during the class will be shared. A HyperStudio presentation to show how the students felt about the class and their enthusiasm will be shared. The attendees will be able to leave with a wealth of ideas on how to incorporate computers into their own curriculums. They will also be able to see what a difference technology can make in the classroom.

Poster Session

Exploring Geometer's Sketchpad at the Elementary Level (Grades 4-6)

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Key Words: geometry, Sketchpad, mathematics, elementary, symmetry, proportion, social studies

Overview

Geometer's Sketchpad is typically used at the junior and senior high school level. We have successfully introduced this program to students in Grades 4–6 for mastery of geometric concepts. Activities include construction of 3-D polyhedrons, symmetrical quilt squares, scale drawings of city skylines using ratio and proportion, and straight line curves.

The program is introduced to students during one or two math periods. The children, as a group, learn the very basics of the program. Using the appropriate vocabulary, the Point tool, the Compass or the Circle tool, the Straightedge or the Segment tool, and the Text tool are explained briefly. Then the students are given time to explore and experiment with the program. Without any hesitation buildings, faces, creatures, and even geometric designs are created. Throughout the room cries of "Wow" and "Look at this" can be heard. The children are fearless when exploring and are continually finding new aspects of the program.

We use the program to supplement and enhance our study of geometry but also are able to integrate it into our social studies and art curricula. Exploration of the sums of the three angles of a triangle allows the children to construct their own triangles and deeply understand the concept. The children use the line of symmetry and the concepts of reflection and rotation to create mirror images. This is a natural progression into creating symmetrical quilt squares in conjunction with the social studies and art curricula. The final squares are printed and assembled as a paper quilt.

The study of ratio and proportion becomes meaningful for our sixth graders as they are asked to construct a city skyline. Students have always constructed skylines using paper, pencil, and ruler. Now the students are able to complete the project using Geometer's Sketchpad. The finished product and their understanding of the concepts far surpass anything we were able to obtain in past years.

We are amazed at how easily children at this age level have grasped the mechanics of a program designed for junior and senior high school. Our students have embraced this program, and we feel that their understanding of geometrical concepts is much deeper than ever. We now realize that programs geared for older children can be adapted to younger children. Workshops for the teachers with time for exploration as well have made this a successful program in our school and have given the teachers the confidence needed to further explore new software and adapt these programs within their own curricula.

Presentation Summary

Samples of student projects, including polyhedrons, symmetrical quilt squares, city skylines, and straight line curves, will be available for viewing as we demonstrate the mechanics of the program.

General Session: Society Session/Technology Training/Staff Development

Logo: The Next Century—The Best of the Logo Exchange

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Key Words: Logo, telecommunications, teacher education, curriculum projects, school reform, constructionism

The development of Logo has crossed paths with the development of the net several times over the past few decades. The first public demonstration of the Internet literally got its wires crossed with a turtle graphics program. The connections between Logo and the Internet are not just historic but cognitive and political as well. Powerful new versions of Logo offer kids unprecedented opportunities to use computers in powerful personal learning environments. Today, the Internet is helping to raise the profile of Logo in countries in which it has been drowned out by the drumbeat of the educational software industry.

Both the net and Logo offer the promise of learning free of arbitrary limits and the tyranny of curriculum. The Internet provides access to infinite bodies of information available to all regardless of grade level, school tracking, or socioeconomic status. The best Logo experiences provide children with an environment in which they can create things beyond their wildest dreams through a process of construction, collaboration, communication, debugging, and discovery. Both the net and Logo challenge the traditional hierarchy of school and democratize learning. Schools can either embrace the opportunities and challenges posed by such technological innovations or become increasingly irrelevant.

The Internet is facing the same sort of school assimilation and trivialization that attacked Logo, regardless of its success. Schools naturally try to use new technologies in safe, non-threatening, and simplistic ways. In short order, these technologies are either so marginalized that they disappear from the landscape or they are used to fortify the status quo. The criticisms of Logo are rarely criticisms of the software or its underlying philosophy of education, but rather criticisms of school: lack of time to do quality work; teachers require professional development; new forms of assessment are required; the lack of curriculum connectedness, and the triumph of the bifurcated curriculum.... This should come as no surprise, because Logo was designed to challenge the nature of school by providing a rich environment in which children can mess about with powerful ideas, construct personal knowledge, and express themselves in a variety of ways.

The most powerful aspects of the Internet, the democratization of publishing and the ability to communicate outside the walls of the classroom, are the most threatening to school leaders. As a result, schools spend a fortune on wiring and little on providing students and teachers with personal e-mail addresses, unfettered Web space, and the time to create meaningful work. The obsession with aimless surfing, TV-sized "net appliances," and severely limited access ensures that the Internet will be used by schools in the time honored tradition of pouring information into kids' heads. As long as the net can be used as one more place to find five facts about whales, school is happy. Outside of school, kids will increasingly have unlimited access and the opportunity for authentic learning and communication.

The Internet supports Logo by providing:

- a forum for isolated teachers to discuss issues of Logo implementation and share project ideas
- an audience for students to present their projects
- a collaborative design environment in which kids can make things together without regard for geography or age

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General Session: Curriculum Design/Strategies

Co-Innovative Tools That Teach Community and Inspire Cross-Curricular Learning

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Key Words: elementary, cross-curricular, geography, social studies, math, language, community

Communities are the center of our lives. Children relate to the idea of a community, so communities provides a perfect vehicle for cross-curricular learning.

This session will feature innovative tools that encourage students in Grades 1–6 to explore their own neighborhoods and other historical and contemporary communities, both real and imaginary. The presenter will demonstrate software that allows children to create maps of neighborhoods and towns, and design and build 3-D models of buildings throughout history and around the world. She will include practical classroom activities that integrate language, math, social studies, and science.

The presenter will also share a variety of student projects. In one example, students use Neighborhood MapMachine to draw maps of real and imaginary places. They draw roads and add houses, buildings, parks, lakes, rivers, people, cars, and objects. Students customize maps with actual street names, pictures, and photos. Students then travel around their onscreen maps learning symbol, direction, distance, and other map skills. They print their maps in a variety of sizes from standard to floor size and use models to lay out a 3-D version of their communities. In this way, students are able to compare 2-D and 3-D representations of the same map. Students also use the program's tools to create mysteries involving map and geography skills for other students to solve.

In another activity, students learn geography, history, math, science, and language as they design, print, and build 3-D models of homes and buildings from their own neighborhoods and other communities. Using the Community Construction Kit software, they select building shape and roof type and then choose from dozens of building parts and stamps from Medieval, Native American, Colonial, and contemporary American building sets. Students print the "nets" or patterns and then cut, fold, and construct to create their 3-D models.

As educators, we know that the best learning takes place when children are motivated and engaged. We look for opportunities to combine multiple learning objectives into compelling cross-curricular activities. Activities like this can help make your classroom a place where this powerful synergy is a way of life.

General Session: Technology Training/Staff Development

Technology Integration and a Teaching Credential: One Model of Preparation

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Key Words: technology-integrated curriculum, teacher education, educational technology, preservice

There are several different ways in which we prepare teachers to be technology-inclusive educators. At one end of the spectrum are courses that focus on basic how-to and are technology centered, at the other end are technology-integrated, Curriculum & Instruction (C & I) (methods) courses. Somewhere in the middle lies the reality for most teacher preparation programs: a separate computer course that is curriculum based.

A Bit of Parenthetical Background

In our professional preparation programs (both multiple- and single-subject) there is some technology, mostly use of the Internet and word processing, throughout the four quarters of the program. At our institution, credential candidates take the course late in the program when they have already taken C & I courses and have had classroom experience. (The state allows five years for its completion; many wait until they have more classroom teaching experience). Curriculum planning and delivery are necessary requisites for this course, as it takes both a step further by integrating technology. The only computer requisite is that teachers be fluent in any word-processing program, which would assure some basic computer operation skills.

Continuing...

And so we begin. Using a constructivist approach, the teachers and I uncover where in their curriculum technology would be a good tool for student learning. Always curriculum first, with technology incorporated as an instructional strategy.

I have several foundational philosophies:

- Teachers in my courses, including student teachers, know their students best.
- Teachers in my course, including student teachers, know their curriculum best.

- Teachers are good teachers, offering students the best practices as they know them.
- Teachers are growth oriented, they are in the business of learning.
- Learning is about discovering, uncovering, scaffolding the new onto present knowledge by evaluating, applying, synthesizing.
- Teachers can do as their own students do: take what they know best (their students and curriculum) and add the new, technology.

Thus, teachers in my classes work on projects that result in enhanced curricula for their own classrooms. Usually they work in grade-level teams. The team approach allows for a process wherein the teachers can stimulate one another by sharing, inventing, revising. Much different than a do-an-assignment/get-a-grade approach.

To that end, while I establish the media to be used, the teachers choose curriculum projects and often involve their own students in its completion.

Teachers use the following instructional strategies and tasks:

- critical thinking
- research
- problem solving
- higher order thinking skills
- presentation

to enhance their curriculum with the following technology tools:

- word processing and graphics (freely drawn, scanned, digital camera)
- database
- slide show

  We use ClarisWorks for the three above.

- hypermedia

  We use HyperStudio.

- commercial software (disks, CDs, laserdiscs, and video)
- the Internet

Some teachers complete thematic units, most incorporate cooperative learning, some design instruction that contains provision for use of the computer lab, most design for rotation to a learning station. All-in-all, the teachers are discovering new paradigms for teaching in the technology-rich classroom.

How is all of this accomplished? Through modeling at every step of the way. I coach. I show. I share. I pose questions, I never “tell.” I never “do” (and it’s difficult sometimes to keep my hands off their keyboards). I stay in the lab hours after class is over until the last teacher is ready to leave. My course syllabus is entirely on the Web, teachers must begin using the technology from the first day. We have a class listserv where we discuss a variety of topics. We laugh a lot.

Workshop

Evaluating Technology Planning and Implementation

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Key Words: evaluation, impact, indicators, technology planning

Summary

School districts nationwide have made dramatic commitments to integrating technology in their teaching and learning environments. As with any planning and implementation effort, a formative evaluation is critical to maintaining progress as well as fine-tuning and improving future implementation efforts. The well-designed evaluation is one that not only answers specific evaluative questions but also inspires reflection and change. The evaluation process we will discuss consists of the following steps:

1. Develop evaluation priorities

   Technology evaluation should focus on all of the varied activities of a school or district's current technology initiative. It is important to resist looking only at technology infrastructure. The task in terms of priority setting is to articulate the district's original vision and teaching and learning goals into viable evaluation priorities and questions. Evaluation teams must answer the question "What difference is this technology making in terms of teaching and learning?" Very specifically, we are looking for student impact.

2. Develop indicators of effective implementation

   This is the heart of the evaluation process as it requires each district to create an evaluation team that develops unique indicators of success for their own district. For example, we may ask, "What does truly effective teacher use of technology look like?" In response, the evaluation team identifies the optimum outcome for use of the particular technology. The major role for

the facilitator in these discussions is to ensure that the team does not under- or overestimate its desired outcomes. The process requires a facilitator experienced in both the realities of the district and the full range of possibilities for any particular technology.

Indicator development does not stop with defining indicators for optimum success. The evaluation team also defines indicators that describe less-than-optimum levels of achievement. Arranged in a matrix, all of these indicators form a rubric to measure the district's success and progress in meeting desired outcomes.

3. Develop data collection procedures

   Once indicator rubrics have been developed, the team develops lists of data and other supporting evidence that must be collected to measure performance within the rubric.

   It is important to note—and this is a point that always needs to be made to the team—that data is not restricted to quantitative information and/or simple survey data. Rather, data can and should include things such as interviews, observations, and a variety of stories about the experiences involved with technology integration.

   Most evaluation teams choose to create a final written report that collects all the indicators, rubrics, and data collection devices/objectives. These materials can be organized into an evaluation plan for the district and presented as such to the district's Technology Committee, School Committee, or other policy/oversight board.

In summary, the evaluation procedure discussed is one designed to inspire reflection as to what constitutes "effective" technology integration. By requiring stakeholders to set their own criteria for success, this evaluation process has the effect of strengthening a district's understanding of technology integration and specifically how it impacts teaching and learning.

Poster Session

Melding Multiple Intelligence Theory and Educational Technology With Lesson Planning

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Key Words: educational technology, teacher preparation, multiple, intelligence theory

The primary question that this traditional poster session addresses is: How and to what degree can an introductory teacher preparation course help novice technology users incorporate multiple intelligence (MI) theory into lesson planning?

During my poster session I will explain how I construct and teach a graduate-level education course that is tailored to pre- and inservice teachers who are primarily novice technology users. At the beginning of the course my students and I explore together the central question: Why should teachers incorporate educational technology into their classroom instruction? As my students brainstorm responses to this query, they invariably comment on how technology can appeal to and motivate a wide range of learners. It is at this point that I introduce, by way of a lecture/discussion, Howard Gardner's multiple intelligence theory. After an explication of Gardner's eight intelligences, I argue that by incorporating a blend of "product" technology (e.g., a variety of computer hardware and software) and "idea" technology (e.g., Gardner's MI theory) teachers are better able to meet more of their students' needs more of the time.

My course consists primarily of instructional units dealing with topics such as visual literacy and design, the Internet and its applications in classrooms, educational videography, and instructional computing and multimedia. I assign several different hands-on projects that enable my students to tap their creativity, apply some time-tested technology principles, and receive corrective feedback from myself as well their peers. The capstone experience in this course consists of a technology-infused, multiple-media project-presentation in which pre- and inservice teachers are required to create a unit of instruction that incorporates a variety of product and idea technologies that they subsequently demonstrate and share with one another. At the conclusion of the course an essay examination is given in which they are asked to respond again to the identical question raised on night one: Why should teachers incorporate educational technology into their classroom instruction? I analyze both their written, in-class essay exams, and their earlier, take-home self-assessments, which they composed for their capstone project-presentations, to discover to what extent they have learned to meld MI theory and educational technology with lesson planning.

During the NECC '98 poster session I intend to share with my audience (a) the primary goals, readings, and projects designed for this course, (b) an analysis of an Action Research Questionnaire that I administered to my students to confirm my perceptions about their level of competency with respect to their knowledge and use of instructional technology, (c) a self-designed PowerPoint presentation that summarizes my students' responses to the central question raised in this course, and, most importantly, (d) the results of my pre- and postanalyses in which I contrast the student feedback I received at both the beginning and end of the course.

I trust that attendees will respond positively to my work, share their insights, concerns, and criticisms with me, and perhaps become inspired themselves to incorporate MI theory into their own classroom instruction.

Internet Poster Session

The Web Exchange: Interactive Web Sharing of Multimedia Files

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Key Words: multimedia, telecommunications, online mentoring, school reform, community, partnership, arts, social sciences

The Web Project, subtitled "Creating a Web of Evidence of Student Performance in Nonverbal Inquiry and Expression," is a consortium of community organizations, private industries, and educational institutions that are using new technologies to effect systemic reform in school systems throughout Vermont. The project uses multimedia and telecommunications as:

- an educational environment for student inquiry and expression
- a medium for presenting and assessing student work
- a virtual faculty room for professional discussions about work

The Web Project is one of the original 19 Technology Innovation Challenge Grant Programs funded by the U.S. Department of Education in the fall of 1995. With this grant, we have been encouraged to act on our most ambitious visions for technology in education reform. We have been encouraged to experiment, to make mistakes, and to learn from our experiences as we go along. In return, we have promised to improve student performance in the areas of Arts, Language, Literature, History, and Social Sciences.

The Web Project's World Wide Web site is designed to house both a public site to showcase our work and a password protected conference area where teachers, students, and online mentors can exchange technical information and communicate privately about student work and other educational issues.

Our password protected area is called The WEB Exchange. It has been designed so that participants can easily upload multimedia information to share. Many people communicate across local, state, and national networks. These shared discussions combine "real time" (synchronous) and "in your own time" (asynchronous) methods of communicating and are held for many different purposes: meetings, student exchanges, online mentoring, project evaluation, general discussion, and as a testing ground for new ideas.

A prototype of the Web Exchange is made readily visible to the general public. This is so that other educators and World Wide Web surfers can see how the exchange works and get a feel for the processes we use without violating the confidentiality of

Web participants.

For more information, visit: http://www.webproject.org/.

National Educational Computing Conference 1998, San Diego, CA

Internet Posters/Curriculum Design/Strategies

Cinquain Creators CyberCorner: Language Arts Redesigned

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Key Words: language arts, Web-based instruction, instructional design

This Internet Poster presentation represents a linear lesson in a language arts unit that originated 25 years ago and was presented at a regional conference. Today the lesson represents an interactive Web-based collaborative learning approach to the same topic and is an engaging learning activity for students in an authentic environment that results in real products.

The site is frame-based and provides continuous access to the contents menu for the learners. The contents menu includes a definition of cinquain, a sample and explanation of the cinquain pattern, examples of word types used in constructing a cinquain verse, completed samples of cinquain verse with accompanying graphics, a picture gallery for the selection of a topic for the cinquain verse with both graphics and animation, activity instructions for students, a page with links at which learners may find other graphics on the Web, a student survey, a teacher cyberstation section stating goals and objectives for the lesson, and other teacher-related topics of interest, including a teacher survey.

The lesson calls on students to use Claris Home Page, Netscape, and the World Wide Web to create a cinquain verse with an accompanying graphic of their choice. The lesson is structured so that students may access the lesson parts in any order they choose. If the contents menu items are followed in a linear manner, the students are led through a step-by-step creation of their verse; however, the nature of the lesson enables students to pursue the construction of their creation in whatever order they choose.

The presentation follows the developmental progression of the Web-based instruction from its inception as a linear lesson, as a collaborative prewriting activity, as a simple media lesson with handout, to its current form on the World Wide Web.

This application demonstrates to educators how they can take a linear, teacher-driven lesson, in this case one that previously used black-and-white, typed overhead transparencies, and transform the same concept into an interactive, collaborative, engaging lesson through development and adaptation to a Web-based approach. The end result for students is one that can be published on the Web by which they may share their creations with others. Language arts is brought alive and is fun.

National Educational Computing Conference 1998, San Diego, CA

General Session: Education Reform and Issues

National Educational Technology Standards (NETS) Project: Defining Technology Standards for Pre-K-12 Students

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Key Words: standards, education, technology, competencies, accreditation, guidelines, benchmarks

As we approach the 21st century, accessing, manipulating, and communicating information are becoming central functions of our society. Processing information from an ever-widening array of resources and applying that information to communicate and to make quality decisions is essential to functional literacy. Modern information skills support collaboration for continuing to learn, accessing collective expertise, creating new knowledge, solving problems, and increasing overall productivity. Technology has become a prime enabling vehicle for carrying out these critical functions.

To develop new classroom environments that address societal demands, educational technology skills and relevant curricular content must be interwoven into learning every day. Technology tools should be used to promote effective learning strategies, such as online information gathering, project-based learning, collaborative projects, and electronic presentations and sharing of data. Consequently, the educational technology standards and performance competencies must be identified and expectations for competence by grade ranges profiled.

The National Educational Technology Standards (NETS) Project, led by the International Society for Technology in Education (ISTE) and funded by the U.S. Department of Education, NASA, Milken Family Foundation Exchange on Education Technology, and Apple Computer, Inc., is developing standards to guide the integration of educational technology in America's schools. ISTE has formed an alliance with leading professional education organizational partners in the NETS Project including:

- American Federation of Teachers (AFT)
- American Library Association (ALA)
- Association for Supervision and Curriculum Development (ASCD)
- Council of Chief State School Officers (CCSSO)
- Council on Exceptional Children (CEC)
- National Association of Elementary School Principals (NAESP)
- National Association of Secondary School Principals (NASSP)
- National Education Association (NEA)
- National Fund for Improvement of Education (NFIE)
- National School Boards Association (NSBA)
- Software Publisher's Association (SPA)

Curriculum Liaisons representing major curriculum groups have also joined this effort to assist in linking the educational technology standards developed with their own subject area standards and practices. They will participate in standards development writing sessions to identify how technology can best support each curriculum area and can facilitate interdisciplinary connections among the curricular areas. Joining the partner organizations in this project are representatives from:

- International Reading Association (IRA)
- National Council for Geography Education (NCGE)
- National Council for Teachers of Mathematics (NCTM)
- National Council for the Social Studies (NCSS)
- National Council for the Teachers of English (NCTE)
- National Science Teacher's Association (NSTA)

To provide guidelines for integration of technology in schools, standards must be developed that address not only student competence but also support use of technology through curriculum development, professional development of teachers, technology planning, and assessment and evaluation appropriate to new learning requirements. The partners envision development of milestones that will guide schools and districts in establishing their local plans for integrating technology with curriculum and management efforts. Initial drafts advocate establishment of learning aimed at providing students with fundamental technology skills learned through practice in meaningful, real-world settings while developing responsible, ethical attitudes towards technology and learning. The following sets of standards for K–12 education are currently under development:

- Technology Foundations Standards—describing what students should know about technology and be able to do with technology
- Standards for Using Technology in Learning and Teaching—describing how technology should be used throughout the curriculum in teaching, learning, and instructional management
- Educational Technology Support Standards—describing systems, access, staff development, and support services schools should provide
- Standards for Student Assessment and Evaluation of Technology Use—describing means of assessing student progress and evaluating the use of technology in learning and teaching

The initial set of standards, describing what students should know about and be able to do with technology generated from NETS Project technology forum meetings and Web input, is available from ISTE. The standards development is based on responses to two survey instruments: (a) Profiles of a Technology Literate Student—for grade ranges Pre-K–2, 3–5, 6–8, and 9–12; and (b) Performance Domains and Indicators Survey—broad areas of technology skills and specific performance indicators for the same grade ranges. Subject-area content standards and examples of best practice addressing both curriculum and technology standards are included in the standards document. This document will guide the efforts of the NETS Curriculum Integration Writing Teams composed of representatives from curriculum-related professional education organizations, teachers of a variety of subject areas and grade levels, and leaders in educational technology as they develop a comprehensive standards document for integration of technology standards in content instruction.

Workshop

Classroom Computer Connections: Electrifying Elementary Lesson Plans and Ideas

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Key Words: elementary, integration, lesson plans, multimedia, Kid Pix, ClarisWorks, HyperStudio

See and learn how to integrate the use of technology into your classroom curriculum. Create stimulating projects for your classroom using Kid Pix, HyperStudio, and ClarisWorks.

I have been working in the Fire Island School District for the past 13 years as a technology coordinator and teacher. We have computers in every classroom, all of which have Internet access, including the Prekindergarten, each with a laser and color printer. The one thing that everyone kept asking me though was, "Now that I have this great tool to gather information, photographs, videos, what do I do with it? How will it help me in my classroom on a day to day basis? How can I include this new technology in my lesson plans?"

This workshop is designed to assist classroom teachers in using technology as a tool to help them cover their curriculum. I will share with the participants several of the projects that the students at my school have completed. These will include the use of three applications that are fairly universal among elementary schools: Kid Pix, HyperStudio, and ClarisWorks. The participants will have the opportunity to create their own projects using these applications, following the sample lessons and plans, which may be saved to disk and brought home with them. Sample lessons might include the following:

Kid Pix: fill in coloring pictures for seasons and holidays, creating online and offline worksheets for letter recognition, beginning sounds and vowel sounds; number recognition and counting; slide show animal research projects for primary grade levels with voice recording and; presenting survey results in a pictograph form.

HyperStudio: on the primary level—frog research project, including poetry writing and student drawings; butterfly research project on metamorphosis; on the intermediate level—medieval research; animal quiz for younger students based on a student-created animal database; stories written for and shared with younger students; and a state research project, world city tour.

ClarisWorks: big book and small book creation, solar system project combining a drawing and word-processing file, using the drawing tools and a spreadsheet for counting, shape and color recognition, using stationary documents for worksheets and or tests, and using the slide show for presentations.

I will provide samples, and guide participants through the creation of individual projects. I am continually amazed at the projects that the students produce with my and the teacher's help. I know that we have benefited from sharing our ideas and projects with each other, and other teachers we know, and I felt that other educators could benefit also.

General Session: New Curriculum Designs/Strategies

Technology and Music Composition: The Road to Education Reform

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Key Words: national standards, MIDI composition, composers, school reform

Summary

This project presents a music curriculum designed to meet the requirements of local and national standards. Through a unique collaboration between teachers and a composer-in-residence, students use the computer as a tool in composing music. The genesis of the program began with the creation of the National Music Standards, Vermont's Framework of Standards and Learning Opportunities, and the Vermont Arts Assessment Project. Specifically, the National Music Standards contain objectives regarding composition and arranging, and evaluating music that were not being addressed. In line with these reform efforts teachers embarked on a course that would take advantage of a comprehensive-standards based program that meets children's needs as it promotes high achievement for all.

The goals of the Composer-In-Residence Program are to enable children with a wide variety of abilities, interests, and experiences to write music and to develop critical listening skills, including the ability to give useful critical feedback. The overall objective of the program is for all students in the General Music class to write music. The role of the resident composer is to guide students through the process, acting as a mentor in the classroom and online. Using MIDI (musical instrument digital interface), a term used to describe the communication between computers and keyboards, students are able to see and hear their music as they create. The composition process is modeled after the writing process in which students write many drafts before the final draft is finished. During this process students are required to use appropriate composition techniques, including accurate notation, rhythm, melody, harmony, and form. Throughout this process the resident composer acts as a resource to the class providing expertise in composition through mentoring as well as technical support for MIDI composition.

Critique and reflection is a vital part of the composition program. Not only do students learn to critique their own work, they evaluate compositions written by students from schools around the state using the World Wide Web. The online critique and evaluation is made possible through involvement with the MIDI Distance Learning Network, which is part of a larger group called the Web Project, a

United States Department of Education Technology Challenge Grant. The Web Project maintains a World Wide Web site where professional composers, teachers, and students respond to student compositions. Students use it to help children revise their work as they near completion of their compositions. Through the process of the critique and evaluation component of MIDI Composition, students are encouraged to think critically as well as learn how to write and talk about music using appropriate vocabulary and music terminology. Students are required to write descriptions of their work that include specific questions about it. These questions are used to assist others in evaluating the composition. Through the brainstorming process, students respond to the questions and then submit their comments to the Web Project online work place.

Participants in this session will learn about the Artist-In-Residence Collaborative Program and how it meets local and national standards. The session will include:

- a model for Artist-In-Residence/music teacher collaborations including tips on working with artists in schools
- a model for meeting the varied needs of all students through MIDI composition, including tips on using MIDI in the General Music class
- a model for connecting national and local standards to the curriculum

Detailed handouts will be distributed during the session.

Poster Session

Using HyperStudio to Create Culturally Consonant Curriculum

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Key Words: multicultural, multimedia, HyperStudio, intelligences, curriculum

Multicultural education is both exciting and diverse. Because of its diversity and expansive growth, educators are now faced with a lack of multicultural instructional materials. Fortunately, technology has grown in our educational system, which allows educators to create their own instructional materials. Classroom teachers can effectively create their own relevant, culturally consonant, instructional materials using authoring software.

In education, multimedia instruction is very effective in addressing the multiple intelligences. Multimedia uses a combination of text, graphics, sound, video clips, and animation to address different styles of learners. This is what makes multimedia so extremely powerful and motivating in teaching. Using multimedia to create your instructional materials will help you reach many different styles of learners in your classroom, including English-language learners.

As a masters project for the Instructional Technology Program at California State University, San Bernardino, a multimedia CD-ROM titled, "A Celebration of Chicano Culture Through Simón Silva's Art Portfolio," was created. This project was a joint effort of an instructor, Nena Tórrez, and a master's student, Kathy Markos. The project was created for use in Tórrez's cultural and schooling classes, which is part of the CLAD teacher credentialing program. Students in the credentialing program learn about the richness of the Chicano culture through beautiful graphics, music, sound, and movies.

General Session: Society Session/K–16 Computer Science

How Can College/University Computer Science Departments Support K-12 Computing?

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Key Words: professional development, technology access, gender equity

Abstract

As computer technology becomes more and more pervasive in the daily workings of our society, it becomes all the more critical for students at all levels to have a basic understanding of this technology. They should be empowered with ability to use a wide range of tools effectively, to be able to envision the future possibilities of the technology, and to understand the wide-ranging social and ethical implications it has. However, in many situations teachers are left with inadequate facilities and training to successfully accomplish this objective, and students are left either without important skills altogether or without the opportunity to learn, use, and be challenged by technology that they have heard about but have no access to. In this session, panelists will discuss various ways in which faculty, staff, and students from college and university computer science departments can support the efforts of

primary and secondary school teachers and students. Included will be ideas both for assisting teachers and for working directly with students at different levels.

Specific topics to be covered in the discussion include:

- Direct assistance in teaching AP computer science
- Teacher training programs
- Programming contests for high school students
- Summer enrichment programs involving computing for middle and high school students
- Programs in computing targeted specifically to girls

The advantages and disadvantages of each idea will be considered from the points of view defined by the experiences of the panelists, all of whom have been engaged in these activities. Issues to be discussed include program details, what works and what doesn't, cost, opportunities for funding, and other topics.

The intended audience includes both college/university-level computer science personnel and K–12 teachers of computing. The former group should gain some ideas for how to attend to the important objective of supporting computing at all levels, while the latter group will be made aware of potential opportunities to seek out for themselves and their students. A primary benefit of the panel will be to open a dialogue between computing teachers and professors about how we can help each other.

General Session: New Curriculum Designs/Strategies

Fifty Ways to Successful Internet Staff Development

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Key Words: staff development, Internet, curriculum, search strategies, information evaluation, scoring rubrics

The presentation discusses a staff development model used successfully in school districts across the United States with more than 3,200 teachers. This model helps teachers learn how to do the following:

- teach Internet searching strategies
- teach information evaluation skills
- develop classroom management strategies
- develop project assessment strategies
- learn how to craft Internet activities
- make use of the wealth of developed activities already available on the Internet
- have success with the Internet as a teaching tool
- use the Internet as an effective and efficient curriculum-based tool.

A portion of the staff development activities are designed to provide educators with the skills needed to help students develop information literacy skills, which will serve them as they deal with the wealth of information currently available and the changes facing them during the 21st century. Information literacy skills include locating, interpreting, analyzing, synthesizing, evaluating, and communicating information. These skills are demonstrated when a learner accesses information efficiently, evaluates information critically, uses information accurately and creatively, and avoids plagiarism.

An additional set of staff development activities are designed to help educators develop curriculum-based Internet projects. The educators spend time finding superb subject-oriented Internet sites and crafting assignments that fit their curriculum. Time is spent learning to develop scoring rubrics designed to fit the Internet projects.

Additional activities related to teaching search engines, evaluating information, scoring student projects, and curriculum-based activities are included as additional materials on the CD-ROM.

Workshop

Teaching Computer Skills in a Curriculum Context

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Key Words: graphics, spreadsheets, word processing, databases, multimedia, classroom integration

> As technology progresses at an ever-increasing rate, adults and young people alike need facility with the various kinds of computer productivity tools, not just as isolated skills but also in a context that makes sense to them. This presentation examines the set of computer skills the average person can expect to need over the next several years and breaks them down into discrete subsets that are within the reach of students and teachers at each grade level.
>
> When one considers the fact that adding "computer skills" to the content task teachers must already address is a formidable task, it is clear that computer instruction must fold itself into regular classroom content instruction. It is critical that a plan for integrating the teaching of such skills must exist wherein the time invested in teaching computer competency is repaid double—in content learning as well as computer skill development. Students and teachers should be able to ride the technology wave that will carry even content itself in a more technologically sophisticated form, whether on an overhead projector or a multimedia presentation unit.
>
> This workshop includes both demonstrations and examples of lessons at the primary, intermediate, middle school, and high school levels for each of the computer

productivity areas (graphics, word processing, spreadsheets, databases, and multimedia presentations), including suggested appropriate skills to introduce to each grade group. Additionally, it will spotlight computer software products from a variety of publishers that lend themselves to successful classroom integration with textbook and curriculum software lessons.

Finally, participants will have an opportunity to experiment with various software pieces, complete sample lessons, and use lesson plan worksheets to plan activities and lessons for students in their own classrooms that teach these critical skills within the context of the teachers' own subject areas.

Workshop

Improving Your Videoconferencing to Maximize Student Learning

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Key Words: Videoconferencing, learning, community of learners

Videoconferencing is a relatively new technology that requires some special preparation to have powerful student learning. This workshop will have three parts: learning about videoconferencing types and strategies, developing and doing a videoconference, and debriefing and designing student videoconferences.

The first part will quickly review many elements of videoconferencing, such as types, what makes a good learning videoconference, what not to do in a videoconference, what equipment and software you need, how to get others interested in your videoconference topic, what different videoconference projects have been done, and how to use planning sheets to structure successful conferences. The participants will see an actual videoconference. They will hear about several videoconferences done for primary through high school audiences. Participants will receive several articles and Web sites about videoconferencing.

The second part moves the participants from theory to practice as they plan and conduct an actual videoconference. They will use a videoconference planning sheet to design their conference and develop visuals for their presentation. They will learn how to use the camera to capture different parts of the videoconference. They will watch each others' videoconferences, comment on the positive learning experiences, and suggest ways to improve the quality of learning in the videoconference.

The third part allows the participants to apply their new knowledge to the design of videoconferences for their own students. Participants will share their designs. They will help each other create videoconferences that engage learners in deep learning. Hopefully, they will find some partners who will want to share in their future videoconference. They will learn how to join educational videoconferencing listservs to invite others to share in their projects.

Workshop

Transforming Elementary Activities Into Constructivist Ones Through Technology

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Key Words: constructivism, elementary, technology, learning

In this workshop you will see some elementary Constructivist examples, learn more about developing Constructivist activities, and then select an activity to transform into a Constructivist activity. We will help each other develop powerful learning activities that are enhanced by technology.

Educators can design the learning environment so that students construct their own knowledge about a topic through the use of real-life technology tools. These student creators can use such technologies as digital cameras, multimedia presentations, the Internet, telecommunications, spreadsheets, and videoconferencing.

The teacher spends much time in helping set the stage for learning and then lets the students take over the stage. Technology helps students focus on the deeper learning. For example, in a Fall Leaves project, the teacher had primary students take pictures of different leaves with a digital camera. The teacher put the pictures in Kid Pix. Then, the students, in small groups, decided on five descriptions for their given leaf. As the teacher showed the leaf image, one group gave its description, which the teacher wrote in Kid Pix. When a second group gave its description, the group had to make sure its description was different from the description for the first leaf.

Hear about how students created their own animal encyclopedia without using any reference resources except their eyes. See how students compared underground railroad information to see trends in the underground railroad movement. Listen to the excitement of students who create their own learning.

General Session: Technology Training and Staff Development

Technology Tag Team: A New Method for Training Teachers and Integrating Technology Into the Curriculum

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Key Words: training, staff development, mentoring, technology integration

Teachers must see how technology can support the curriculum and visualize themselves as successful technologies users before students will have true technology integration into their learning. The Jessamine County Schools in Kentucky has implemented a TAG team to make this happen.

In typical situations in takes from three to five years for teachers to feel comfortable enough with technology to integrate it into the curriculum. Using the TAG team concept of one teacher mentoring others, the time is reduced to less than 18 months! The TAG team concept uses the idea of "just in time learning," or making training available when the person is ready for it and not just when it is convenient to schedule. Research already has shown that teachers learn best by planning and working collaboratively.

We will share a model that is working in Kentucky. This model allows for great student achievement and encourages principal and district support.

A Web site has been developed to share information with other teachers. The potential benefits are staggering for teachers to have the ability for automatic uploading and downloading of appropriate technology-rich lesson plans.

The following are URLs relevant to our model.

Jessamine County Research Manual, Technology Integration Curriculum
http://www.jessamine.k12.ky.us/research/Research.html

Tips and Tricks for Mentors
http://www.jessamine.k12.ky.us/jcbo/tipstricks.html

Jessamine/Scott Counties Technology Competencies
http://www.scott.k12.ky.us/project/main.html

Jefferson County Public Schools, Jefferson, Colorado, Jeffco Online
http://jeffco.k12.co.us/di/jeffco.html

Alaska Department of Education
http://www.educ.state.ak.us/hs/technology.html

FromNowOn.Org
http://fromnowon.org

General Session: Curriculum Design/Strategies

The Kids Network Supplements: 21st-Century Science in the Classroom

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Key Words: elementary, science, Internet, telecommunications, standards, inquiry

TERC, in collaboration with the National Geographic Society (NGS), is designing, testing, publishing, and marketing new material to extend the scope of the seven units in the NGS Kids Network series for students in Grades 3–6. The additions to Kids Network will reflect current research on science learning and teaching, support the National Science Education Standards (NSES), and respond to the changing needs, knowledge, and skills of Kids Network teachers. Topics covered include water quality, acid rain, pet ownership with a focus on genetics and behavior, weather, nutrition, trash, and solar energy. The unit-specific supplements will incorporate:

- open-ended, student centered activities
- activities for using the new Kids Network software (NGS Works) for data sharing and analysis
- interactive Internet activities
- open-ended, interdisciplinary activities
- flowcharts and tables to help teachers plan and implement a unit
- daily and cumulative assessments

The supplement to the *What's in Our Water?* unit will be available commercially in 1998. During 1997–98, the developers will field test new material for *Hello!, Weather in Action, Acid Rain*, and *What Are We Eating?* These materials will be available in 1999. During 1998–99, the developers field test *Solar Energy* and *Too Much Trash?* These materials will be available in 2000.

One test-teacher speaks for many when she says, "Kids learn a 'ton.' It [the new material] is engaging stuff. It is nice to see things work out, to see kids learn and grow." Another teacher comments, "This material has made me see the power of the Internet as a learning resource. It has also shown me that there is more to data analysis than the traditional paper-and-pencil approach. I've seen what happens when you send kids to the computer and let them go." Students say, "We like this stuff. It's fun to click." For fieldtest information, contact judy_vesel@terc. edu.

For ordering information, see the Kids Network section of the National Geographic educational catalogue or telephone NGS at 1.800.368.2728.

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General Session: Special Needs

The AlphaSmart Pro Keyboard and Students and Adults With Learning Disabilities

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Key Words: learning disabilities, special needs, adaptive technology

I like the AlphaSmart Pro keyboard. I also like my Macintosh computers, including a PowerBook. For many of the writing tasks I do every day, the AlphaSmart Pro is a better choice than my PowerBook. It's also a better choice for many of the students and adults I work with who have learning disabilities.

Simple Operating System

The most compelling reason to use an AlphaSmart Pro keyboard is that it has a simple operating system: you turn it on, do some writing, then turn it off. There is nothing to read on the screen to open or save a file. There is nothing to memorize to operate this computer. You turn it on, use it, and then turn it off.

For students and adults with learning disabilities, separating writing from the operation of a computer, even an easy-to-use one, is a good thing in that it allows for more writing and less concentration on the writing tool.

Inexpensive

The AlphaSmart Pro is inexpensive. Because of this, more people can own one who might not be able to afford a desktop or portable computer. Expense is part of total access to computing; it's part of the interface between computer and human.

Also, the low cost of the AlphaSmart Pro, coupled with its ease of use, makes it a more casual machine to carry around. With this can come more use.

Battery Life

The AlphaSmart Pro can get up to 300 hours on two AA batteries. The better alkaline batteries will give the AlphaSmart Pro more life. This means that thinking about battery life as you sit down in a library to take some notes is no longer an issue.

Compatibility

The AlphaSmart Pro is compatible with most desktop computers in that it generates plain text and emulates a regular computer keyboard. This means that it could be used as a go-between between a Macintosh at home and a Windows machine at school or work. Just send the text from the Macintosh to the AlphaSmart Pro and then send it from the AlphaSmart Pro to the PC. Then, after you're done working on the text on your PC you send it back to the AlphaSmart Pro. Of course, because the Macintosh will read PC disks, you might also use a disk to get the same effect. But you can't work on a disk on the school bus!

Access Features

AlphaSmart Pros have a few access features that some people will find useful. You can control (turn off) auto-repeating keys. You can turn on a sticky-keys feature that allows you to use the shift and other modifier keys without holding two or more keys down simultaneously. You can press the keys sequentially.

The AlphaSmart Pro key layout can be changed to Dvorak from standard QWERTY, and the machine can be configured for either right- or left-handed typing.

Conversational Writing

Have students start a story on an AlphaSmart Pro and then after two minutes tell them to stop and pass their AlphaSmart Pro to the next person to their right. Everyone in the class now has someone else's story. They read the story in front of the group and continue where the last person left off, taking the story in a new direction or continuing along the same path. This continues until the AlphaSmart Pro you started with is back in your own lap.

To keep the language clean tell the students that you will ask them to read the stories aloud when the exercise is done. (It's fun to do this anyway.)

Send study questions or vocabulary lists back to the AlphaSmart Pro. Make up a series of questions or a vocabulary list on your desktop computer and then send it to each student's AlphaSmart Pro so that they can take it home with them, write between your lines, or open a new file to write in.

Use the AlphaSmart Pro's different files for different things The AlphaSmart Pro has eight different files (storage places) that can be opened by pressing buttons on the keyboard. Each file is opened by a corresponding button: F1, F2, and so on. Because the files are separate memory spaces, you can put different things in them, including the following:

- Put your daily schedule in one file.
- Put a name and address list in another.
- Put a to do list in another.
- Jot down jokes your friends tell you in another.
- Keep your assignment list in another.

- Put course notes in another.
- And you have two more to do what you like with.

General Session: Special Needs

More Ways to Use an AlphaSmart Keyboard

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Key Words: learning disabilities, special needs, adaptive technology

Now that I've been using an AlphaSmart for a few years and have met hundreds of other users both in and out of the education world, I'm amazed at how limited people's imaginations are about using this most revolutionary tool.

Yes, students being able to do electronic composition instead of writing in a spiral notebook and transcribing onto a computer at school is fantastic, and certainly enough, but there's so much more that can be done with an AlphaSmart keyboard.

Below are some ideas for using AlphaSmarts that you might not have thought of. Most of them are things that you can do, not your students. Oh, you don't use one yourself?

Use the AlphaSmart Yourself

Last year, at NECC, at the AlphaSmart focus group meeting, I was amazed at how few people in the group actually seemed to have experience using the AlphaSmart to do their own work. All of them had experience using it in a classroom, but few seemed to take one home themselves or use it for their paperwork at school.

So, I recommend that those of you who like this tool actually try using it yourselves. Most of the rest of these ideas come from that idea.

Take Notes at Meetings

This seems obvious, but I'm amazed at how many people fire up PowerBooks and ThinkPads at meetings for simple note-taking chores. Laptop computers are battery hogs and/or need AC support, take longer to start up, have noisier keyboards, and have more software resources than are needed for simple note-taking chores. I take my AlphaSmart to every meeting I attend where I plan to take notes.

Tip: Put notes you are bringing to the meeting in F1 (file 1) and take notes in F2 (file 2). You can switch back and forth easily by hitting the F1 or F2 keys.

Collect Names and Addresses

Pass your AlphaSmart around a room to collect names and addresses instead of having people fill out a form that will eventually have to be transcribed into a computer. This way you've got the information in text form from the start and can eliminate a time-consuming step. Obviously, you can collect any kind of information this way.

Make AlphaSmarts available for checkout at libraries. The library connection seems obvious to me, but I have a hard time convincing librarian friends of mine to try this. Make 10 or more AlphaSmarts available at the circulation desk for in-house checkout. Students and other people doing research can take them into the stacks or sit down at tables with them and do their work. Then they can take them to the library's computer area and upload into a text file and save it on disk to take home.

Or have the AlphaSmarts available for checkout to take home and eliminate the middle step, allowing people to take the information directly home to their computers.

Use AlphaSmarts on Airplanes Instead of Battery-Hog PowerBooks and ThinkPads

Face it, when you walk down the isle on many flights and see people using laptop computers (mostly non-Macs I might say), at least half the time they're playing solitaire. Okay, you can't play solitaire on an AlphaSmart, but you can do your writing. So carry both: a laptop for playing solitaire and an AlphaSmart for doing the real work.

Seriously, I never take my PowerBook out on planes, preferring to write with my AlphaSmart. It's smaller and when I'm sitting in coach (most of the time until I become rich or famous) it affords me more room to move. The batteries last long enough so that I never think about them running out. I can use it for a while and then stow it at my feet (I'd never put my PowerBook down there), and it will definitely become a conversation piece with the computer-using business person sitting next to you who

- makes fun of it as a toy
- makes fun of it as a toy but is really envious but afraid to show it
- is secure enough to show interest and asks you where you got it
- won't leave you alone to do your work because he/she has to have one immediately!

Take Notes at the Beach

Okay, summer is over (boo!), but for those of you who live south of, say, D.C., you still have a bit of beach time left (after school). Take your AlphaSmart to the beach and catch some rays while you dump your thoughts about the crappy novel you're reading because you spent a fortune on the hardcover edition you *had* to have.

Move Your Writing Environment to a Warmer or More Scenic Place in the House

This will sound like I live in the "country." Well, I do, and we heat our house with wood. In the morning, before the wood stove has generated enough heat to warm the chilly upstairs part of our house where the office is, and while I'm sipping coffee, stoking the fire, and watching the Weather Channel seeing if I'll be able to fly to place x to make a living, I almost always have my AlphaSmart with me making notes about what I'm going to be doing upstairs when my office defrosts.

Record Brainstorms More Spontaneously

I always get my best ideas when I'm as far away as humanly possible from a way to record them. I think this must be a law of physics.

When I'm laying in bed at night or in the morning it's easy to have an AlphaSmart sitting by the bed, ready for action. Be careful what kind of action you interrupt.

In the shower, though, you're on your own; maybe Ketan and Joe will make a yellow, underwater AlphaSmart someday.

But anywhere I get a brainstorm I can sit and record it. Being able to work away from AC is important and really does affect your work style.

If I want to do some writing and sit near our stove, or sit near the window facing the pond, or sit near the window where the bird feeders are so I can think about what it is I want to write but also track the comings and goings of our goldfinch population, the AlphaSmart is the tool that allows me to do that. And I can do it without much thought: just pick up the AlphaSmart and move to the new location and get to work.

Lately, I've been spending time outside cutting firewood. Cutting trees down is a dirty, noisy business and I love doing it. (Don't cringe, environmentalists, we're not clear-cutting, just thinning a lot of forest around our place.) Invariably, right in the middle of this process when I'm totally dirty, sweaty, in my kevlar chaps, gloves, and visored helmet, I'll have a brainstorm. Sitting on a log (out of the way of falling trees) is my trusty AlphaSmart. I can take the gloves off, fire it up, dump a few thoughts in, and get back to work.

My wife would kill me if I ran into the house with mud on my shoes and wood chips flying off my back just to write a few notes that came to me outside. Actually, she already has yelled at me many times for this, so she loves the AlphaSmart too because it keeps our house clean.

General Session: Emerging Technologies

Zebu: Turning Your Computer Network Into a Learning Environment

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Key Words: communication, collaboration, groupware, World Wide Web, project-based learning

Educational software has evolved from the use of the computer as a tutor, tutee, and tool, to the computer acting as a medium for communication and collaboration between students. This new stage in the evolution of educational software represents the convergence of network technologies with educational theories that recognize the importance of shared activity and interaction in the construction of knowledge by learners.

An example of this emerging educational technology is Zebu, an educational groupware product developed through a collaborative venture between researchers at Simon Fraser University and MC2 Learning Systems Inc. Zebu builds on the capabilities of the World Wide Web and offers some unique solutions to the general problems of making the Web a constructive medium for educational activities. Zebu is server-based and requires no specialized client software other than Netscape Navigator. The system allows students to edit the contents of their Web pages "live" over a TCP/IP network by manipulating objects within a Web page displayed in a Netscape window. Students need not learn any sophisticated HTML or page-editing software, and the management of the site is handled by the system. Students can, therefore, focus their efforts on the substance of their work and think in terms of the projects they are working on rather than the mechanics of making a Web site. Teachers and students have tools for building and managing collections of information resources. These tools are integrated into the system such that resource collections can become integral parts of "live" pages. Teachers can scaffold productive student activities by providing information resources, instructions, and structures for further activity within "template" pages that students can clone and use as starting points for their own work. These templates allow teachers to create supports to get students immediately involved in specific, valuable project work, while providing an open-ended environment for students to pursue interests and add intellectual value to available information. Finally, the system supports collaboration by allowing students to group-edit individual pages and whole projects, allowing for asynchronous text-based discussions within their pages, and providing simple mechanisms for teachers and students to coordinate group-based project activities.

This session will demonstrate Zebu and highlight its main features. As part of the demonstration, examples of student and teacher work will be shown.

General Session: Curriculum Design Strategies

The Technology Competencies Database: Distributed Teaching, Assessment, and Portfolio Management

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Key Words: technology standards, technology competencies, technology requirements, technology in teacher education

The teacher education programs at the University of Illinois at Urbana-Champaign have no single, foundational course in instructional technologies. Rather, we depend on our instructors to infuse relevant and appropriate instructional technologies into each course in our teacher education programs.

Recently, NCATE adopted the ISTE developed standards that identify the critical instructional technology concepts/topics that should be included in all teacher education programs. Given the distributed structure of our approach to incorporating technology into our programs, we felt the need to develop a software tool that would assist instructors in situating specific technology experiences within and across a series of courses. In addition, we needed a system that would enable instructors to collaborate effectively in assessing students' competence regarding each standard. Further, we wanted a system that would provide student access to their records and an easy means of submitting evidence in support of their attainment of the required skills and experiences.

To meet this need, we developed the Technology Competencies Database, a World Wide Web-based software tool that will enable a group of faculty to collaborate more effectively in providing technology experiences to their students. The TCD is a FileMaker Pro database running on a Macintosh computer that is also a World Wide

Web server. Students and instructors interact with the system at any time of day and from any location using any Web browser software.

The TCD contains individual records for all students and enables them to submit statements and materials in support of their attainment of the ISTE standards (which we refer to as the Technology Competency statements). These submissions are accessible by the students' instructors, and the students and instructors may exchange messages regarding the competency statements, the students' submissions, and any additional work that will be required by the instructor.

The students' submissions and the faculty responses are all preserved in the database and can be sorted in various ways to provide the faculty with reports regarding where each competency is addressed in each program and, most importantly, what kinds of activities each faculty member is accepting as evidence that each competency has been met.

We feel that the TCD system will be very valuable in helping us to ensure that each student is being held to identical standards of performance. In addition, it will help us demonstrate where and how each technology competency is acquired by students in our programs. Further, it will allow the students to maintain an online portfolio of their technology experiences.

General Session: Technology Training/Staff Development

Utah Technology Awareness Project

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Key Words: inservice, preservice, assessment, training, rubric, competencies, Utah

Where?

The Utah Technology Awareness Project (UTAP) is housed at http://www.uen.org/UTAP/. Guests may log in to explore the tool. To use the tool privately, a user must be a registered UtahLINK educator.

What?

UTAP helps teachers see what they need to learn to effectively leverage technology in the classroom, impacting both inservice and preservice teacher training. It was influenced during its development stage by the ACOT research. UTAP was developed with a state-managed challenge grant and is a Web-based self-assessment tool for teachers.

Why?

Teacher Technology Needs

- What is possible with technology?
- What training is available?
- Which training is most likely to provide growth?

Technology Trainer Needs

- Know which skills teachers need during class design
- Reach teachers needing skills offered by trainer
- Valid feedback on effectiveness of classes

State Reporting Needs

- Level of technology use in classrooms
- Amount and effectiveness of training offered to teachers
- Best practices descriptions

Who?

Project partners include the Utah State Office of Education, UtahLINK, three Utah Colleges of Education, SEDC (a six-school district consortium in rural southern Utah), and the regional laboratory WestEd.

How?

The team developed rubrics at four levels that describe the competencies in seven categories of teacher technology use, including basic concepts, personal and professional productivity, communication/information management skills, classroom instruction/management skills, educational leadership, technical troubleshooting, and technical leadership. From those rubrics, online questions were devised that (1) help teachers gauge their current competencies, (2) show development possibilities across the rubric, (3) chart growth of competencies over time, and (4) match teacher needs to available training. State, region, district, and school reporting on teacher training needs are also included. Trainers enter class offerings online and correlate the class objectives with the rubrics. UTAP correlates teacher needs to available classes. UTAP also offers feedback to trainers on student growth. UTAP was integrated into an already existing Web-based educator, school site, and training databases at UtahLINK (http://www.uen.org/utahlink/) to leverage statewide work already done by the Utah Education Network. It uses a Java serviette to process requests to and from a Sybase relational database. UTAP benefits the following groups:

Teachers

- self-assess technology awareness
- view customized lists of most likely appropriate training available

Trainers

- view rubric of technology skills
- query-assessed needs before designing courses

- post upcoming training that's correlated to rubric levels

Interested Users

- preclass and postclass assessment data
- see current status of teacher technology awareness
- see change over time

When?

UTAP's visioning team met in August 1997. The writing team met in October 1997. The first online version of the implementation rolled out in January 1998. Three schools from the SEDC area piloted the online version of UTAP from January to May 1998 during the formative evaluation of the project. The SEDC region will implement UTAP from May 1998 to May 1999 and Utah will roll it out statewide in June 1999.

Workshop

From A to Z: Designing Effective Instructional Technology Plans

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Key Words: technology planning, staff development, K–12 instructional technology

The technology plan for the School District of Holmen, recognized in Volume 14, Number 7 of *Electronic Learning* (April, 1995) provides the basis for this tiered workshop. Technology planning, staff development, curriculum development, and infrastructure building are the foundation pillars and focus topics that provide the template and model for smaller school districts with fewer than 3,500 students, K–12. Four members of the technology committee and the Holmen School District staff will offer their unique perspective and expertise on:

1. Infrastructure Building. Networking schools, building local and wide area and fiber networks, direct connections to the Internet, hardware and software issues, technical support, and maintenance.

2. Funding Technology Projects. Grantwriting, district technology budget planning, state and federal initiatives, and technology referendums.

3. Instructional Technology. Addressing the needs of

educators, support staff, and students via on-going staff development, incentive programs, and support for the integration of technology via the K–12 computer literacy curriculum.

Resources relevant to this workshop will be available in June 1998 at http://www.holmen.k12.wi.us/.

General Session: Educational Reform and Issues

The Louisiana Challenge: A Systemic Model to Enhance Student Achievement by Networking Underserved Communities

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Key Words: Louisiana, Challenge Grant, networking, parental involvement, professional development, community

> The Louisiana Challenge grant consortium was awarded one of the original 19 Challenge Grants by the U.S. Department of Education. Funds from the $4.5 million grant are being used to develop, implement, and evaluate comprehensive district plans for using educational technology to raise the level of student achievement and to attain educational goals.
>
> The consortium consists of five Louisiana school districts: Natchitoches Parish Schools, Calcasieu Parish Schools, Jefferson Parish Schools, Lafayette Parish Schools, and Monroe City Schools. In addition to the five districts, LaSIP plays a vital role in the project by providing leadership and coordinating activities among

the districts. The consortium will address the following goals:

> 1. to develop transferable models for ensuring equity of access for underserved students
>
> 2. to increase student achievement via the use of telecommunications by addressing school readiness, professional development, parental involvement, school-to-work transition, and life-long learning skills
>
> 3. to document successful practice for widespread use

During the first year, each district developed standards-based curriculum materials and expanded access to off-campus locations at community centers, playgrounds, libraries, and churches. Professional development activities for teachers, students, parents, and administrators of community organizations will be offered.

During the second and third years, additional community sites will be added and teacher-developed curriculum materials will be disseminated online through the ISTE gopher and Web servers.

During the fourth and fifth years, videoconferences will be used to transfer model practices to other parts of Louisiana. In addition, the project will work with the Louisiana Board of Elementary and Secondary Education and the Louisiana Board of Regents to develop technology standards for preservice and inservice education.

Related URLs:

> Louisiana Challenge
> http://www.challenge.state.la.us/
>
> USDE Challenge Home Page
> http://www.ed.gov/Technology/challenge/
>
> Monroe City Schools
> http://monroe.k12.la.us/mcs/
>
> Jefferson Elementary
> http://www.gnofn.org/~jeffelem/
>
> Calcasieu Parish Schools
> http://hal.calc.k12.la.us/
>
> Natchitoches Parish Schools
> http://www.nat.k12.la.us/
>
> Lafayette Parish Schools
> http://www.lft.k12.la.us/

Spotlight Session

State of the States: NCATE/ISTE Foundation Standards for Teacher Education

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Key Words: NCATE/ISTE Standards, preservice teacher education, technology, college survey

The North Central Regional Educational Laboratory (NCREL), the North West Regional Educational Laboratory (NWREL), the Southeast and Islands Regional Technology in Education Consortium (SEIRTEC), the Pacific Southwest Regional Technology in Education Consortium (PSWRTEC), and the North East Regional Technology in Education Consortium (NetTech) conducted a survey to determine how colleges and departments of education are meeting the technology standards set by NCATE from the perspective of the college/department of education dean or department chair. Specifically, we were interested in knowing the current level of compliance with the NCATE standards, the plans for and barriers to compliance, and in what areas, if any, outside help may be needed in the area of computers and technology in preservice teacher education.

To this end, an independent marketing research firm was commissioned to conduct the study to provide each Lab or RTEC with an understanding (among colleges and universities within its region of the country) of:

1. how computers/technology are currently being taught in teacher preparation programs (required/elective courses offered, which colleges offer the courses, presence of certification or degree programs, whether they have separate technology courses or have integrated technology into other courses)

2. awareness and reactions to ISTE/NCATE standards (satisfaction with the guidelines, the extent to which universities are in compliance or plan to comply, barriers to compliance)

3. current needs universities have regarding computer and technology (current plan or strategy to comply with standards, who in university is responsible for compliance/technology plans, what type of help needed from outside sources)

Interviews with 336 participants were conducted across the country. The following are some of the highlights of the survey findings. The area of computers and technology, with or without NCATE standards compliance being a concern, is an important one among colleges and universities. Three of every four respondents indicated that their institutions were in the process of developing and/or implementing a plan for computers to comply with NCATE standards. However, throughout the data, respondents expressed a level of uncertainty about how to best proceed. Respondents recognized the need to increase computer technology in their programs but also were balancing that need with limited resources (lack of funds, aversion to technology by teachers needing training, the need for more/better equipment, etc.). After a plan has been developed and implemented, there needs to be a method of assessing the graduates' proficiency and the effectiveness of the technology courses.

For this session, the panelists will give a general national overview of the survey findings and then will give more detail regionally. Discussions with participants on the findings and what implications for change may be forthcoming will be encouraged.

General Session: Technology Training/Staff Development

A Report on a Three-Year, School-Based Inservice Project

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Key Words: professional development, technology integration

Abstract

We report on the success of a three-year professional development model for integrating technology into elementary mathematics and science instruction. Teachers' thematic units and video of classrooms will be shared.

The need for continued professional development of teachers is quite compelling. In this project, we report on the development and validation of a professional development model for integrating technology into elementary science and mathematics instruction. The professional development model was designed to be aligned with the most recent recommendations for effective professional development (NCTM, 1989, 1991; AAAS, 1990, 1993; NRC, 1994). For example, NCTM (1991) prescribes hands-on, student-centered teaching and authentic, performance-based, instruction-driven assessment procedures as necessary components of effective instruction in mathematics. The appropriate application of technology provides a viable means to assist in achieving changes that more closely meet these instructional mandates. The project, a collaboration of a college of education and a Southwestern school district, was funded by a National Eisenhower Grant.

A total of 102 teachers from four elementary schools with high minority enrollments participated in a one of three phases of a professional development program. During the first year, 54 teachers from two schools participated. In the second and third years, the professional development program was revised and another school was added each year. In the first year, Cohort I teachers participated in 18 three-hour weekly sessions after school during the school year and a 10-day intensive summer session. The second year of the project, Cohort I teachers received training in 9 three-hour weekly sessions and a five-day summer session. In the third year of the project, these teachers participated in seven 2.5-hour workshops and 15 hours of online activities. The Cohort II teachers participated in the project for two years and the Cohort III teachers participated only for the last year. First-year workshop topics included setting up the hardware (a Mac AV computer with display, laserdisc player, and 27" monitor/receiver); loading software; using word processing, spreadsheets, and databases; using production software such as Kid Pix and HyperStudio; using laserdiscs; and so forth. During the school-year sessions, instruction in a topic and opportunity for individual practice was provided. Then, teachers were expected to use the newest information/techniques in their classrooms and report at the next session on the successes and challenges they had encountered with the use of the information/material.

Data were collected from the participants during the school year and summer training through surveys, teacher interviews, and teacher journals. An analysis of data revealed that the technology integration strategies of first-, second-, and third-year participants were different according to levels of experience. First-year teachers had students work in small groups, and groups rotated through the multimedia station by taking turns. They had students create class newsletters, develop HyperStudio stacks in which each student contributed a card or two, and search for information in electronic resources. Second-year teachers developed six-week curricular units during the summer. They designed projects using four to six stations. For example, students gathered research information using multimedia sources and print sources (station 1), constructed habitats and maps (station 2), wrote reports (station 3), and designed HyperStudio presentations (station 4). Third-year participants negotiated with colleagues to obtain more technology for a period of time, e.g., six technology carts for two weeks. They tackled larger projects in which students spent more concentrated time using technology.

The presenters will share their CD-ROM and/or videotape to bring to life technology-enriched practices demonstrating teachers using small-group work, independent research, and student-directed problem solving. Also, the presenters will share thematic units the teachers developed while integrating technology in science and mathematics. These units are available through our Web site at http://www.west.asu.edu/kwetzel/title.html.

Workshop

Kid Pix Activities Across the Curriculum

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Key Words: curriculum integration, mathematics, multimedia, spreadsheet

The purchase of adequate copies of good software is often a barrier to effective use of technology. Teachers can substantially augment their curriculum with licenses for a modest number of products. Most computers in schools already have an integrated program, such as ClarisWorks or Microsoft Works. With the addition of Kid Pix, a child-appropriate multimedia package, you have most of the software you need to create numerous activities that incorporate curriculum goals. In the workshop, many new and varied Kid Pix activities that complement different aspects of the elementary curriculum will be demonstrated and practiced. Kid Pix is so versatile that teachers can easily create activities for K–6 students.

Kid Pix is a paint program with so much more. It has many different tools that appeal to the child in all of us. From the "wacky pencil" to the "stamps," you can paint fun pictures in a flash. Along with its painting capabilities, you can use the elements of Kid Pix to create activities in math, reading, science, social studies, and other areas. It also has a companion program called Slide Show. Working with files created in Kid Pix, the Slide Show can turn the single pictures into an animated presentation, with voice-overs, sound, and other features. You can even include digital pictures. Kid Pix can also work in tandem with ClarisWorks or Microsoft Works, especially with the spreadsheet capabilities. Data from worksheets can be represented well and imaginatively using Kid Pix.

The workshop activities have been incorporated in numerous settings and found to be an effective way for children to process information in a multisensory manner with the visual, kinesthetic, and auditory components of Kid Pix. Children thoroughly enjoy the colorful elements of Kid Pix along with the neat sounds it makes when you use the tools. They are highly motivated to use the program. Teachers can take advantage of that, along with its versatility, to integrate activities on the computer that complement what they are doing in the classroom.

The morning will be devoted to math activities. Participants will solve problems and design activities that match their own curriculum outcomes.

In the afternoon we will incorporate the use of the Slide Show component of Kid Pix that allows multimedia presentations using drawings, the microphone, and digital pictures. Varied applications of Slide Show will be tied into curriculum in language arts, science, and social studies—everything from students creating their own multimedia presentations to animation (i.e., graphs with changing data, the growth cycle of a plant, and so forth).

Poster Session

Technology Resources in Elementary/Middle School Astronomy Education

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Key Words: astronomy, space sciences, elementary, middle school, hands-on, projects

This presentation will include simple and inexpensive hands-on light and color activities, a teacher resource list of print, software, and a World Wide Web site (enclosed as separate file) to integrate astronomy and space science concepts into upper elementary/middle school classes.

Examples of hands-on activities will include a color filter activity, a simple diffraction demonstration, and "homework" for students to do: moon, sun, and stellar observations.

Software examples will include screen shots of programs I have used with my elementary students, as well as an annotated list of software suitable for these age groups.

Print examples will include trade books, an outstanding children's astronomy/science magazine, and manuals/software listings available from the various astronomy/space science projects I have worked with: NASA (Ames NEWEST and STELLAR), Harvard Smithsonian Center for Astrophysics projects (ARIES and SPICA), Astronomical Society of the Pacific (ASTRO Project), and other examples of state and national astronomy education projects.

World Wide Web resources will include extensive listings of astronomy-related sites, as well as interdisciplinary extensions for math, social sciences, art, and multicultural, including Spanish, Pacific Islander, and Chinese.

This poster presentation will be enhanced by brief visual experiments and extensive handouts in addition to the resource list enclosed.

Workshop

Physical Places, Virtual Spaces

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Key Words: virtual communities, international, exhibitions, technology grants, writing, publishing, MOO environments

The purpose of this workshop is to offer participants a look at virtual communities as a place where education occurs. Participants will be introduced to two projects, Collaborator and Hawaii eSchool. Both are based on the notion that education is neither a time nor place, but a process.

Collaborator is an international initiative that brings together K–16 students, museum personnel, corporate staff, and members of charitable organizations. The hub of activity is both in the local communities in which students reside as well as on Walden3, a virtual community on the Internet. Teams of students work on their own interpretations of culture by creating museum exhibits and displaying these in their local museums. Students are asked to act locally and share globally, and begin to understand the possibility of contributing to both places.

Technology is certainly not viewed as a substitute for great teachers, but it does offer an essential way to extend their reach and motivation as well as magnify their effectiveness. Of course, in some cases technology can be the main means of an educational model. In the case of Hawaii's eSchool, a project in response to a $4.6 million Challenge Grant, classes are being offered entirely in virtual form. One such class, "Journalistic Writing Virtual View," is a year-long course that develops student writing in the context of publishing an ezine (electronic magazine) on the Internet. The URL for the course is http://www.k12.hi.us/~pawillia/writing/Welcome.syllabus.html. This course has allowed students in Grades 7–12 to collaborate and communicate on ideas.

The hub of activity for both projects is on Walden3, a MOO (multi-user virtual community) especially created for the collaboration, conversation, and the sharing of perspectives and project designs.

General Session: Exhibitor Session/Technology Training/Staff Development

Creating a Mentor Program for Your School or District: Infuse and Enthuse

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Key Words: inservice, technology, curriculum, teachers, integration, mentoring

Technology education programs often teach educators how to use equipment or software, but the real need is to see how to integrate the technology into lessons or daily plans. Instituting a mentor program reaps benefits for both the mentor and the teachers needing mentoring.

Supporting and assisting other teachers does not fall merely to the teacher who is a technology whiz. Many teachers not known as tech wizards have identified some outstanding ways to integrate technology into their teaching days. In fact, their ideas are often very simple and most appealing to other teachers who are just beginning to add the use of technology into their plans. Meanwhile, the teacher who has been extremely motivated by technology and has learned how to use a wide variety of tools and programs may be ready to put their experiences into a useful perspective. They can share what they have tried that did not work or did work, giving the mentored staff member an opportunity to learn from someone else's successes and mistakes.

Mentoring one's peers is not something everyone can do. Even educators who are outstanding in front of a classroom of K–12 students do not instantly become good mentors. A training program must be established for the mentors. The mentor training program needs to establish the objectives of what the district or school needs to have accomplished by the mentors. The mentor training program needs to serve as a clearinghouse for the handouts and lesson plans mentors want to use (districts or schools need to know what is being distributed by the mentors). The mentors also need the preparatory program to practice presenting their lessons and presentations to one another and receive feedback and ideas from other mentors. The mentor program also gives the mentors a chance to know one another's skills so that they can call on one another when necessary. They also need this time together to share one another's enthusiasm and ideas, a professional opportunity that is always rewarding!

No matter who is selected as mentors, the underlying issue is that a program needs to be developed around the existing curriculum, where the activities undertaken with technology tools support the curricular goals and objectives of the school or district, making the teaching/learning tasks more effective, efficient, or engaging. Mentors need to develop presentations and demonstration lessons to help their peers understand ways to assess when, where, why, and how technology can enhance a lesson. They need to present the mentor lesson fluently, with organized support and sample materials for the teachers. Again, their message must go past the "how to" level, addressing the philosophy and rationale of the lesson.

Mentors must be exemplary teachers, enthusiastic and well-versed in the content and the process of their lessons. They must have a wide range of options developed in their lessons so that they can adapt to the realities of the available technology in one classroom versus another. They must put the use of technology into perspective with other print, audio, or experiential resources they encourage the teachers to use. And, above all, mentors must remember to be extremely honest with their peers about time needed for preparation and development of lessons, while also giving hints and sharing ideas for making the addition of technology reasonable for a novice to consider.

Mentors need to have compassion for the differences among their peers, knowing that not all teachers have fallen in love with computers and technology; they may even fear technology. To work in such environments, the mentors must have skills for identifying other teachers' strengths and passions so that they can help each person see where technology ideas can "fit" in their style. While making the actual use of technology "transparent" within the context of their mentoring, mentors need to have options for leading their teachers to district classes and resources for gaining the technology skills they may lack.

Mentors convey enthusiasm and expertise by demonstrating their commitment to the curriculum. By using high-tech tools in the process, the mentors usually show such enticing examples that reluctant or inexperienced teachers become eager to begin adding the technology tools to their lessons, too. The classes that teach teachers how to use equipment and software can then have more meaning and usefulness for the teacher and the students.

"Teachers Teaching Teachers" is the theme of the year-old Pioneer Mentor Program. Developed to provide teachers with creative approaches for introducing curriculum content using a variety of technologies, the program has been very well received. Both presenters for this session helped design this program. Their experiences will be presented, and several of the mentors who are attending the conference will be available to discuss the details of their participation.

General Session: Curriculum Design/Strategies

Using the Arts as a Springboard for Integrating Technology Into Curriculum

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Key Words: technology integration, curriculum, interdisciplinary

Technology can be integrated with multiple subjects to produce a dynamic learning experience for your students! At Echo Horizon School we attempt to integrate several subject areas across disciplines. In this session, I will discuss the process of collaboration between students and teachers that leads to year-end, live multimedia productions. While some teachers may not be interested in creating large-scale productions, everyone will see a variety of technology-infused activities that can be used in any number of subjects. I will show video clips, discuss the planning processes, and demonstrate the role of technology in such events.

Four productions, A Musical Multimedia Journey Through American History, AFRICA!, Journey to Greece, and Yosemite, were performed by sixth graders over a four-year period and served as culminating events for projects that encompassed a variety of curricular areas. Social studies and science provided themes for the projects, which contained dramatics, music, and dance and featured visual art, poetry, and prose created by the students. They were accompanied by a variety of technologies including laserdisc images, computer animation, scanned images, video, and tape-recorded music and sound effects.

Each of these productions began as "germ" ideas in the minds of teachers at Echo Horizon School. We met several times to choose fertile themes, share ideas, and develop outlines of integrated projects. Each teacher worked with the students to develop different portions. As the project evolved, student input became central to the end result. Each year of the production, a different emphasis was placed on the various subject areas, depending on the students and teachers involved.

Once the individual components of the project were complete, students had to combine the parts to formulate a show. A lot of creative problem solving occurred at this point in order to coordinate the arts, technology, and other core curricular subject areas.

Approaching a theme from several perspectives made it more attainable to all and proved to be a rich experience for students and teachers alike.

Participants will leave this session with new ideas and fresh inspiration for integrating technology into multiple subject areas!

Poster Session

A Multimedia Approach to Teaching Kinematics

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Key Words: computer, interactive, videodisc, kinematics, physics, high school

Educators' interest in the use information technology (IT) defines at least two broad goals. These are the development of technologically literate students and the integration of IT into the teaching/learning environment.

Significant effort has been, and continues to be, specifically targeted at the first of these goals—and with considerable success. The second of these goals, however, is likely of more profound interest to teachers because it represents the application of IT to the practice of their craft. The achievement of this goal not only offers the potential of improving the teaching/learning situation, it can also contribute significantly to the achievement of the first goal through effective role modeling. Despite this, the integration of IT into the teaching/learning environment remains one of the biggest challenges facing educators. All too often applications of IT either do not propagate or are successful only at the pilot-test phase.

This presentation describes the development, pilot testing, and successful multiyear experience associated with an innovative application of hypermedia/multimedia technology in physics. Specifically, the presentation addresses the question of whether a Computer-Assisted Interactive Videodisc (CAIV) approach represents a viable alternative (or complement) to the traditional approach to teaching and learning.

Findings generally indicate that students have a positive attitude toward the CAIV approach. Academic performance was not compromised as a consequence of using CAIV—results further indicated that students working in self-selected pairs displayed higher levels of achievement than those who worked alone. The average learning time when using the CAIV approach was less than half of that usually spent with the traditional classroom-based approach. Overall, results indicate that the

CAIV approach seems to be a viable complement, if not a potential alternative, to traditional instruction on the topic of interest.

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Internet Poster Session

Steve Yuen's Ultimate Search Page

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Key Words: search engine, World Wide Web

With the explosion of the Web in the past four years, it grew so large so quickly that it became practically impossible to find anything at all. Fortunately, many Web users realized that something had to be done and began to develop search engines. Today, the many search tools on the Web allow you to quickly locate almost anything you want. Best of all, most of the search tools cost nothing to access. This Internet poster allows participants to view my Ultimate Search Page on the Web. In addition, participants can go through my search engines tutorial to learn about the strengths and weaknesses of some of the latest top search engines, and receive tips on selecting the right search engine for the right job. Participants can then use these effective searching techniques to locate almost any page on the World Wide Web, Internet Usenet newsgroups and listservs, e-mail addresses, software, online references and services, publications, technical reports, media, and other educational resources.

Steve Yuen's Ultimate Search Page is located at http://dragon.ep.usm.edu/~yuen/search.htm.

General Session: Curriculum Design/Strategies

Soar Online With Native American Students: Keypals Intercultural Telecollaborative Experience

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Key Words: Internet, Native Americans, keypals, e-mail, intercultural, telecollaborative, curriculum integration

Online culture-sharing among Native American K–6 students in Maine, Washington, New Mexico, California, Nevada, and Eatontown, New Jersey, public schools has proven to be an exciting keypal project. Merging Internet power and the Native American "storyteller" tradition of sharing culture, students in Eatontown, New Jersey, and Native American students in other states have formed an online, intercultural learning partnership. Exploring the lessons in their social studies curriculum with their keypals has given them a new insight into their lessons. Through their keypals' personalizing of history and sharing of their experiences, historical and geographical facts have come alive for all students.

Eatontown Public Schools K–6 students and Native American K–6 students in other states have formed a pilot learning partnership to bridge the sea of misinformation about Native American culture. Communicating online, they shared questions and answers about Native American life now and long ago. The Native American students also were provided with the opportunity to learn about life in Eatontown, New Jersey, a few miles from the Atlantic Ocean.

After reading about Native Americans in various parts of the country, cooperative learning groups of students composed e-mail messages on their classroom computers using ClarisWorks. Then they saved their messages on a disk so that their questions could be copied and pasted into the e-mail form on an online computer when their class went to the computer lab or library.

The format of this project provided flexibility to overcome the coordination problems of accessing and using the Internet with K–6 students, when a single modem or only a few modems are available in a school.

Internet Security concerns were easily handled because incoming e-mail to students was screened by teachers in the computer lab or library for appropriateness of message content before students read and printed it to share with their classmates.

Meeting in their cooperative learning groups to compose well-thought-out questions for their Native American keypals, students discovered that they needed to do some "real research" through a variety of sources (books, CD-ROMs, the Internet). Consequently "writing for real reasons," students were provided with opportunities to improve their communication skills while they explored the Internet through this guided social studies curriculum project.

Native American keypals and their teachers, our students, parents, teachers, and administrators have all enthusiastically endorsed this project. They found it to be a meaningful and stimulating method of learning history, developing communication skills, and improving cooperative learning skills.

In June, the accounts of cultural sharing were published as a loose-leaf notebook of e-mail: Soar With Native American Students—KITE—(Keypals Intercultural Telecollaborative Experience).

To share and review the cultural information compiled during this project, game cards were relevant facts were produced on the computer and used as questions for giant intercultural What Do You Know About Native American Life?/WOW—KITE BINGO games on our magnetized blackboards, and these exciting games were videotaped. This video will be used to introduce other students to the interesting information discovered during this living history project.

This intercultural/telecollaborative keypal project with Native American students and Elders extended the scope of our original intergenerational online living history project, Windows Online to the World—Then & Today. Opportunities for students to develop skills needed to experience success in school and meet the New Jersey Core Curriculum Content Standards were developed and practiced through this project.